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ABSTRACT

In this 1977 publication, findings and recommendations are presented from 22 case studies involving the impact on schools adjacent to highway systems in the states of California, New Mexico, Colorado, Texas, Missouri, Maryland, and Virginia. The impacts described include: noise; vehicular and pedestrian safety; air pollution; access; circulation changes in service area; and visual distraction. The cases illustrate the range of perceived impacts associated with various types of school/highway positionings and the range of mitigation measures utilized to minimize negative impacts and their relative success. Positive impacts on schools include increased vehicular and pedestrian accessibility, and visibility from the road. Negative impacts include noise, safety, air pollution, and visual distraction. No perceived positive impacts are reported on the highway system from the school; negative school-to-highway impacts include traffic congestion, circulation, and decreased vehicular safety. Twenty-six broad recommendations are provided to minimize the adverse impact resulting from school/highway juxtapositioning. An appendix provides background and study objectives along with study methodology. (GR)

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schools located near highways:

PROBLEMS & PROSPECTS

final report

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August 1977

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16. Abstract

This report identifies and describes the perceived impacts highways have on adjacent schools and the perceived impacts schools have on adjacent highways. The impacts described include: noise, vehicular and pedestrian safety, air pollution, access, circulation changes in service area, and visual distraction. The study findings and recommendations are based on an analysis of twentytwo case studies in the states of California, New Mexico, Colorado, Texas, Missouri, Maryland, and Virginia. These cases illustrate the range of perceived impacts associated with various types of schoolhighway adjacency situations, the range of mitigation measures utilized to minimize impacts and their relative success.

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final report

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SUMMARY

SUMMARY

The objectives of this study were to define the local and state decision-making processes that are involved in school and highway locations; to specify the range and intensity of perceived highway proximity impacts on schools and school proximity impacts on highways; and, to develop recommendations that would promote the beneficial aspects of school-highway proximity as well as avoid or mitigate negative impacts.

Institutional Context

Planning process issues were found to have a significant effect on the degree of beneficial or adverse impact arising from the adjacency of a highway and a school. Because many of the most effective mitigation measures become infeasible or prohibitively expensive once a facility has been constructed, the planning process can be more crucial than the ultimate mitigation measures taken. The major issues that result from the present institutional setting of and planning procedures utilized by School Districts and State Highway Departments include:

- Identification of those impacted -- In the past, highway departments were perceived to have identified impacted users on the basis of complaints or protests raised during construction or operation of a highway. Passage of NEPA and the incorporation of environmental assessment procedures into the highway planning process has increased recognition of those potentially impacted.

- Assignment of responsibility for identifying and measuring impact -- There is often a significant lack of coordination and understanding between those identifying and measuring impacts (usually Highway Departments) and those experiencing them (usually school users). School Districts lack the expertise and funds needed to plan and implement effective mitigation measures. They are sometimes unable to understand the implications of alternative site locations or mitigation measures proposed by State Highway Departments and lack the capacity to generate alternatives. This tends to limit their ability to make optimal use of the public comment opportunities that are a part of Highway Departments planning procedures. The result is sometimes that School Districts do not respond to planned highway improvements until construction starts.

- Categorical funding of new construction and mitigation measures -- The categorical nature of highway funding means that highway funds can only be used to mitigate certain impacts (i.e., noise, loss of property) caused by a state or federally funded highway. The schools may be impacted by noise from both a highway and a local street which serves as a feeder for the highway, but funds would only be available to mitigate noise from the highway. There is a relatively narrow categorization of impacts which may be mitigated through the funding programs encountered in the study. There is, however, a substantial amount of flexibility in determining the optimal mitigation measures to be used once it has been determined that a particular situation qualifies for mitigation. This flexibility enables knowledgeable school districts to develop innovative corrective measures in conjunction with State Highway officials. In the absence of informed school staff officials and creative State Highway Department staff, this flexibility is under-utilized.

Highway Impacts on Schools

The major positive impacts of highways on school was increased vehicular and pedestrian accessibility, and increased visibility from the road. These impacts were perceived to be most beneficial to private schools and large secondary schools drawing pupils from a large service area.

The major negative impacts of highways on adjacent schools were noise, pedestrian safety, air pollution, access, changes in service area, and visual distraction. Table II summarizes the major effects of each impact, factors influencing sensitivity, mitigating measures, and the case studies experiencing these impacts.

Schools Impacts on Highways

Schools were found to have relatively few impacts on the highways adjacent to them. There were no perceived positive impacts of schools on highways. The major megative impacts were traffic circulation and congestion and decreased vehicular safety. Table III summarizes the effect of these

TABLE 2

IMPACTS OF HIGHWAYS ON SCHOOLS

Impact	Effect	Factors Influencing Sensitivity	Mitigating Measures	Case Study Identifier
Noise	• Speech interference • Hearing interference • Aggressive behavior	• First language of children • Hearing acuity of children • Spatial relation between school/source of noise • Highway configuration • School site plan • School building design • Climate	• Noise barriers: walls, berms, landscaping • Sealing openings and air-conditioning • Depression of roadway • Building and site plans • Building materials	3, 4, 5, 6, 10, 12, 13, 15, 16, 18, 22, 23, 24
Pedestrian Safety	• Accidents • Anxiety • Parent-Teacher Community Organization	• Age of children • Spatial relationship of school and highway • Traffic type/speed/volume	• Grade-separated pedestrian facilities • Traffic control devices • Crossing guards • Busing program • Physical constraints • Safety education program	3, 4, 7, 8, 10, 16, 17, 18, 19, 20, 21, 24
Air Pollution	• Physical discomfort; headaches, nausea, sore throats • Limited outdoor play/exercise time • Decreased athletic performance	• Ambient pollution levels • Proximity and wind patterns • Method of school building ventilation • Pupil type • Activity type	• Depression of roadway • Airconditioning • Restrictions on pupil activities	3, 4, 24

Impact	Effect	Factors Influencing Sensitivity	Mitigating Measures	Case Study Identifier
Access	• Lengthen pedestrian distance to school • Isolation of school from service area • Decrease vehicular and pedestrian traffic safety • Changes in school useage	• Type of school • Availability of alternative transportation modes	• Pedestrian over/under passes • Signalization • Signing	3, 7, 8, 9, 10, 13, 14, 16, 18, 23, 24
Changes in Service Area	• School closings • Changes in school useage • Reduced attendance	• Type of school • Type of financial support	• Land swaps with Highway Department • Route location	5, 8, 14, 17, 22
Visual Distraction	• Student inattentiveness	• Type of school • School building design	• Landscaping • Site design	3, 7, 23, 24

TABLE 3

IMPACTS OF SCHOOLS ON HIGHWAYS

Impact	Effect	Factors Influencing Sensitivity	Mitigation Measures	Case Study
Circulation	• Congestion • Accidents	• Type of school • Mode of travel -- staff and students • Highway configuration • Time of day	• Traffic control devices • Loading/unloading zones for busing and passenger cars • Separate turning lanes and acceleration/deceleration lanes	10
Vehicular Safety	• Damage to vehicles caused by thrown objects • Accidents • Diminished usefulness of play fields	• Proximity of overpass to school • Number of students using overpass on walk to school • Proximity of play field to roadway • Height of existing fencing	• Fencing of appropriate height around play fields	3, 22, 24

impacts, factors influencing sensitivity, possible mitigating measures and case studies experiencing these impacts.

Recommendations

Broad recommendations designed to minimize the adverse impact resulting from adjacent school and highways were developed based on the data obtained from the case studies and the subsequent analysis of perceived impacts and mitigating measures. These recommendations are:

(1) Postulated environmental impacts should be described, both quantitatively and qualitatively, in terms which permit school officials and community groups to fully understand the findings.

(2) The planning process associated with the design of new schools near existing highways should be expanded so as to facilitate inputs of transportation-knowledgeable individuals.

(3) Responsibility for school-related traffic safety should be assigned appropriate staff in both the schools and highway department; mechanisms should be established to ensure a continuing interface between these individuals.

(4) Where state or federal noise impact abatement funds are to be used, the cost-benefit analysis of mitigation measures should include the possible closure or relocation of the school facility.

(5) School site planning procedures should include the provision of adequate loading/unloading zones for both bus and passenger vehicles which are well separated from major traffic patterns.

(6) The installation of traffic control devices or provision of roadway improvements should always be preceded by appropriate traffic engineering analyses which determine the nature and extent of the problem and viable solutions.

(7) Special attention should be given to the traffic engineering characteristics and issues associated with suburban high schools; realistic estimates of traffic-generated characteristics of these facilities should be included in the planning of highway improvements.

(8) In instances where school playground and playfield facilities are adjacent to existing highways, high fences should be provided around such facilities, particularly along those portions of the perimeter directly adjacent to the highway.

(9) Additional research is required regarding the absolute and relative noise sensitivities and resultant impacts in terms of differential school activities, user types and facility characteristics; results of such research should be incorporated into revised standards for predicting noise impacts.

(10) Highway designs providing for the use of depressed roadway sections near school facilities should incorporate measures which mitigate reflective noise impacts.

(11) For controlled access roadway sections near schools designed at grade, a combination of berms and soundwalls should be required, where feasible, for effective noise mitigation; landscaping techniques should be included to minimize negative visual distraction.

(12) For elevated roadways, adequate provision should be made in the structural design to accommodate the installation of soundwalls.

(13) The design of roadways near schools should incorporate grade-minimizing techniques to minimize noise effects.

(14) Freeway interchange designs should include consideration of ramp configurations which maximize spatial separation between the ramp and adjacent or nearby school sites.

(15) Where not needed as safety measures for pedestrians, traffic control devices which interrupt traffic flow should be minimized in areas where the highway and/or interchange is located in close proximity to school facilities.

(16) Given the availability of practical alternative routes, diversion of truck traffic from highways near schools should be considered during school hours.

(17) School site planning considerations should include the placement of parking, playground, and instructional facilities so as to achieve maximum buffering of noise-sensitive activities.

(18) School remodeling plans should consider various techniques for noise mitigation, including the installation of air conditioning, caulking and sealing of windows, doubling windows or increasing glass thickness, use of small soundwalls, and in extreme cases as a last resort, filling-in of windows.

(19) Pedestrian grade separations should be incorporated into highway designs only after other safety measures have been shown to be inadequate.

(20) Pedestrian grade separations should, where possible, be overpasses rather than tunnels; positive guidance measures should be considered to ensure utilization of these facilities.

(21) For junior high or intermediate schools located near highways, consideration should be given to the use of crossing guards.

(22) State and local student transportation standards should consider the relative pedestrian hazards of the journey to school rather than the absolute distance involved.

(23) School sites and facilities should be designed such that primary pedestrian routes are adjacent to controlled crosswalks.

(24) As school service boundaries change over time, new highway facilities should be designed so as to permit the future addition of pedestrian and vehicular access facilities.

(25) Estimates of the fiscal impacts associated with the construction of new highways, or major expansions of existing highways, should include an analysis of tax revenues subvented on a per-pupil basis as well as local property tax revenues.

(26) Air conditioning should not be considered a solution to the effects of photochemical pollution.

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1.0 INTRODUCTION

1.0 INTRODUCTION

Background and Study Objectives

Previous studies of highway impact have not focused upon the impacts of highways on adjacent schools and of schools on highways. It has, however, been generally assumed that schools are particularly vulnerable to negative highway impacts such as noise and pedestrian safety. This study's objective is to identify and describe the impacts associated with school-highway adjacency situations and the mitigation measures used to minimize impact.

This report is based on findings from twenty-four case studies undertaken in six states. The case studies were designed to identify and describe the impacts schools and highways are perceived to have by the users and operators of both facilities. Cost considerations precluded technical noise, air pollution and circulation studies being a part of this effort. It is felt that user perceptions and judgements may be as valid a measure of a highway or school's impact as highly technical graphs of related noise and pollution levels. The table on the following page identifies the school-highway situations studied and summarizes the major impacts associated with each.

In a period of declining highway and school construction, it is important to note that the impacts of improvements to existing highways and schools can be, and frequently are, as severe as those normally associated with new construction. The case studies indicate that interaction between a school and a highway may be recurrent. A four lane freeway is constructed or a new school is located next to a four lane freeway. Interaction may be quite sustained until mitigation measures are negotiated or users become habituated to the impacts. Interaction ceases until the highway requires expansion, or a new

TABLE 1

CASE STUDY PERCEIVED IMPACT SUMMARY

Schools	Case Study Identifier	Noise	Pedestrian Safety	Air Pollution	Vehicular Safety	Changes in Service Area/Usage	Visual Distraction	Access	Fiscal Impact
L.A. Southwest College	1							4	2
San Diego Military Acad.	2							4	4
Soto Street Elementary	3	3	3	3	2		2		
Rinaldi Street Elementary	4	3	2	2					
Hoxie Ave. Special School	5	3	1			3			3
Fiesta Gardens	6	3	1					1	
Harris	7	1	3		3		3	3	
Dodson	8	1	2	1	2	3		3	
Mt. St. Agnes College	9	1						4	
Del Norte High School	10	2	3	1	2			2	
Hixson Jr. High School	11					1		1	
Visitation Academy	12	3							
McCleur High School	13	3						2	
Goodall Elementary	14					2		2	
Central Inst. Deaf	15	3	1						
Gove Junior High School	16	2	3		3			3	
Barrett Elementary	17		3			2			
Moore	18	3	3					2	
Wyman	19		3					1	
Swansea	20		2	1					
St. Thomas Moore Elem.	21		3						
Cameron Elementary	22	3				2	1		
Baltimore Lutheran High	23	2			2		2	4	
Maiden Choice Elementary	24	3	2	2			3	2	

1 = Minor Impact
2 = Moderate Impact
3 = Severe Impact
4 = Positive Impact

Impact

exit which provides the impetus for another round of interaction. Several case studies were selected because of impacts associated with original construction. During field work it was learned that planned improvements to either school or highway had resulted in new discussion between the users and operators of both facilities. In several instances where the highway or school was constructed many years ago, the interaction surrounding the proposed improvement was the first to have occurred. Where there had been interaction in the past, school participants were frequently surprised at the procedural and attitudinal changes they perceived to have taken place.

Finally, since the impacts of highways on schools tend to be far greater than the impacts of schools on highways, and because highway departments are more centralized and therefore more visible than School Districts, there is a tendency to lay blame for highway impacts on Highway Departments. It is essential that that tendency not obscure the fact that schools and School Districts are sometimes as large a factor as Highway Departments. It was not uncommon for a School District to have built a conventionally designed school along the right-of-way of a proposed highway, or to have added classroom buildings even closer to the adjacent highway. The Highway Department planning process, is today, very tightly structured, open to public review and responsible for being responsive to public comment. The same cannot always be said of School Districts' facility planning procedures.

Given the objective of minimizing the adverse impacts of adjacent schools and highways, it must be recognized that School Districts' responsibility for availing themselves of the opportunities for comment explicitly provided for in State highway planning procedures is as great as the Highway Department's reponsibility for maintaining federally mandated access to their planning procedures by schools and other members of the public.

Section two of this report presents an analysis of the institutional context in which highway and school locational decisions are made. This section summarizes the planning process of local School Districts and state and local Transportation/Highway Departments, delineates relationships between the two, ad discusses major planning process issues. Section three presents the study's findings on the impacts highways have on adjacent schools. Each major type of impact is discussed in terms of its effect on school users, factors which influence relative sensitivity to impact, and mitigating measures used to minimize impact. Section four contains the study's findings relative to schools' impact on adjacent highways. Section five presents recommendations for minimizing adverse impacts resulting from adjacent schools and highways.

2.0 INSTITUTIONAL CONTEXT

2.0 INSTITUTIONAL CONTEXT

The institutions and organizations that make decisions affecting the location of schools and highways including State Highway Departments, local Traffic Engineering, and Transportation and Planning Departments and School Districts are institutions with disparate expertise, experience and constituencies. Although the level of interaction between these agencies varies from city to city, their interface is generally limited to those relatively rare occasions when a highway/school situation develops with the planning or construction of new or improved facilities or in dealing with operational problems. When these situations occur, it is not surprising that communication between the participants is sometimes difficult, compromises hard to reach and the decision-making process complex.

However, it is, in large part, the interaction of these organizations that determines the impact highways will have on schools and schools will have on highways. Any effort to mitigate or avoid negative impacts in the future must begin with the institutional context in which decisions are made and the relationships that exist between these institutions. This section presents an overview of the institutions, their objectives, planning procedures, and expectations and an analysis of those issues that seriously effect individual or joint efforts to mitigate or avoid negative impacts at the present time.

2.1 School Districts

The objectives of a school district are obviously related to the provision of educational services to school age children and, in some instances, to adults. These general educational objectives are relevant to this study only when they result in policies or procedures which affect the School District's ability to identify, ameliorate, or avoid negative impacts from school-highway proximity relationships.

Interviews with School District staff and school staff indicate there are common policies and practices which are applied to such negative impacts.

1. Relationships Between District Staff and School Staff

The concerns of School District Administrators are frequently significantly different from those of school personnel. Communication about site-specific problems between District and individual school staff is frequently inadequate, either because the communication procedure is not well defined or the initiative is not taken by the appropriate individual. For example, school personnel can be greatly concerned about changes in land use that follow freeway construction and affect their service area. 2 District personnel are rarely opposed to such changes because these changes have long-term positive impact on School District revenues. Since District staff are not physically located in the schools impacted by highways, they tend to be unfamiliar with actual impacts and may, in fact, be dismissive of school staff complaints. This communication phenomenon is important because when highway departments do seek comment from schools, they are generally sought from District personnel who are frequently far removed from the school in question and unfamiliar with the potential impacts new highway construction or improvement might have on that particular school.

2. School District -- State Departments of Education Relationships

State Departments of Education promulgate rules and policies which bind local School Districts and which can affect a District's ability to respond to adverse highway impacts. Specific policies vary between states, but examples include busing rules, site selection criteria, and categorical limits on capital expenditures. Districts faced with the need to air condition a school in order to mitigate noise impacts, or provide busing for students not normally qualifying under state distance-related guidelines may find no provision for these measures in state regulations. This usually means that proportionate state aid will not be available. Many districts facing declining enrollments are now financially incapable of funding any capital improvements or major additions to operating or maintenance expenditures without substantial state or federal aid.

2.2 State Highway Departments

The State Highway Department has historically been an extremely powerful and independent agency with a strong, supportive federal as well as state constituency. In the past, those Departments were perceived by the public as being extremely conscious of their power and perogatives, and less than receptive to local or community concerns. Although Highway Departments have made a concerted effort to involve the general public in their planning process, this image (regardless of its validity) persists and is a source of continuing concern since it affects School District, school and PTA actions. In several instances, school personnel, who had serious problems with proposed improvements, failed to initiate contacts with the Highway Department because of this perceived image. The action, therefore, had to be initiated by students, parents and local politicians.

The objectives of State Highway Departments are directed toward the provision, improvement, and maintenance of state and interstate highways. Their concern with the impact of these highways has historically tended to be focused on resolving access, congestion and traffic safety issues. National environmental assessment requirements and those of some states have changed the planning process by also requiring a complete analysis of social, economic and environmental impacts as well. These guidelines have resulted in massive studies and paper products in the form of environmental impact statements and/or reports. However, while adhering to the letter of the law, the spirit of consultation and coordination is sometimes lost because there is too little communication and it comes too late in the planning process.

One school-related respondent found the environmental assessment process "an exercise in futility. They never listen." Another, when asked what he would do if he found himself in a situation in which a new highway was proposed adjacent to his school, said, "Nothing. You can't do anything when they decide to build a highway. They just build it." This legacy, from a more laissez-faire past, may have tended to blunt the impact of new federal and state regulations designed to insure that present and future highway construction and improvement adequately consider the impact such action will have on local communities and individuals.

It was also apparent from interviews with State Highway Department personnel that there is enormous variation between State Highway Departments with respect to the timing and extent of consumer representation in their planning process. Similar attitudinal variation could be found between personnel within the same State Department.

2.3 Planning Procedures and Techniques

Many of the factors presented above also affect the planning procedures utilized by school districts and state and local Departments of Transportation.

Since many of the most effective mitigation/avoidance strategies become impossible or prohibitively expensive once a facility has been constructed, the planning process is critical. This section describes the planning procedures utilized by the State Highway Departments and School Districts involved in the case studies.

2.3.1 School District

Because School District facility planning procedures are subject to significant variation, it is difficult to develop a single, protypical procedure which adequately reflects actual practice. However, basic components of the process remain constant even when implementation varies. The basic components in the School District facility planning process include:

New Facilities Planning

- Determination of Facility Need.
- Site Investigation and Selection -- Based upon population growth projections and site availability, this may involve a formal assessment of site constraints, including highway and traffic impacts; it is more often, a very informal, idiosyncratic process. Occasionally this is done by an interagency committee. This committee typically contains representatives of the School District, City/County Planning Department, and Traffic or Transportation Departments.
- Local Approval of Site -- Final local approval of a site normally involves only the District staff and Board of Education.
- State Approval of Site (When State Regulations Require) -- Although this approval may involve an interagency committee, it is more typically approved only by the Department of Education. Site plans may be sent to "impacted" Departments for their review and comment.
- Site Acquisition (if property not owned by the School District).
- School Planning and Design -- This may be done in-house by District staff, or by architectural firms on a contract basis. Consultation with local or state agencies and recognition of site

constraints such as noise and local traffic patterns is critical at this stage. In some Districts, local input from agencies, school staff and parents is obtained through a Design Advisory Committee.

Existing Facilities Planning

- Determination of Need for Modification or Expansion -- In response to requests from the user community, school staff or District staff. Agency in control of funding makes the final decision.
- Impact Investigation -- Rarely performed by the schools. If performed, it is usually undertaken by traffic or highway agency at the request of the schools. Feeds back into determination of need.
- Determination of Funding Source -- Usually done by the school user community and school staff, sometimes with aid of School District.
- School Planning, Design and Cost Estimating -- By District staff or architectural consultants. When funding is to be provided by other agency, usually State Highway Department, they reserve veto power over design as related to projected costs.
- Construction -- under the control of the School District even if funding is provided by another agency. If federal aid is used, extensive monitoring and reporting is required.

2.3.2 State Highway Department or Local Transportation Agencies

While highway and transportation planning is undergoing change as a result of changes in federal program requirements, especially the Federal Highway Program Manual, the highway planning process continues to be an essentially three-phase process:

1. Project Definition: This is the initial phase which identifies the potential need for a project and sets the stage for additional site-specific planning efforts. The identification of the need usually results from statewide or regional transportation planning efforts involving the analysis of current and future travel volumes. Projects are then classified and assigned priorities

for further planning, design, and construction; at this time, appropriate agencies with responsibilities for the project are also identified.

2. Project Location Planning: This phase usually involves engineering and environmental inventories of the project area, thorough studies of all possible alternatives (including the potential for making no improvements), and the preparation of an Environmental Impact Assessment, Report or Statement. At this stage, Locational Public Hearings are held in order to gain public input on the corridor location and alignment. The results of these studies and meetings are used to select a final corridor location for the project.

3. Project Design: After the corridor location has been established, the final phase in the planning process prior to construction is the design of the project. The project is initially designed in detail, including the determination of exact right-of-way requirements. A Design Public Hearing is then held to insure that public input is included in the design. Utilizing the input from the hearing process, the design is then finalized and bid documents are prepared.

Although the above procedure is specifically defined and required for all projects which will be at least partially funded through federal sources, it is being utilized for more and more local projects as well. The only difference is that the level of detail and effort involved will vary considerably depending on the scale of the project or improvements.

Community participation procedures mandated by various federal laws and regulations generally involve preparation of a mailing list of government agencies, elected officials, and individuals and organizations who might reasonably be expected to be impacted by the project or who request listing. Notices of meetings and hearings are published in general circulation newspapers, generally in the legal notices section. Brochures, newsletters, and press releases are also used to inform the public. The scheduling of report review periods, the holding of meetings and hearings, and even the advertisement of those meetings is defined in the regulations.

Through this procedure, it is the responsibility of the State Highway Department or the local agency to make an effort to contact all parties impacted by the proposed project. Thus, if it is expected that a particular school is to be affected, the School District should be notified, be involved in discussion of the plans, and be invited to participate in meetings and hearings. However, if impacts on the school are not evident to the highway planners, school officials must take the initiative to bring to light potential impacts that they foresee.

By federal law, some schools come under the protection of Section 4(f) of the Federal Department of Transportation which permits only the Secretary of Transportation to approve a project that requires the use of publicly-owned land from a park, recreation area, wildlife or waterfowl refuge, or historic site and then only if: (1) there is no feasible and prudent alternative to the use of such land, and (2) such a program includes all possible planning to minimize harm to the Section 4(f) land resulting from such use. Section 4(f) is potentially applicable to public schools if their recreational areas are open to and used by the general public without restriction.

2.4 Planning Process Issues

Throughout the case studies, a number of issues emerged which, although not impacts per se, had a profound effect on the relative benefits or disadvantages arising from the adjacency of a highway and a school. These issues concerned the allocation of responsibility for recognizing and measuring impacts, planning for the enhancement of those which were beneficial and the mitigation of those which were negative, and securing funding for and implementing appropriate mitigating measures. The studies served to emphasize that the process was an issue, at times, more crucial than the product measures actually taken.

Clearly, the nature of the planning procedures used by the two types of institutions are far from complementary. The school facilities planning process is frequently far less subject to public review and comment than is the highway planning process and it can be even more difficult to obtain information about planned activities from School Districts. However, since the impacts of schools on highways is substantially less significant than highways on schools, the effect of their procedures is less significant. The following paragraphs describe the major planning issues that result from the present institutional setting of and planning procedures utilized by School Districts and State Highway Departments.

2.4.1 Identification of Those Impacted

Defining the critical distances at which schools and highways will have some kind of impact upon each other is not a simple matter. The process may involve projecting noise contours, the boundaries of taxing jurisdictions, or specification of the routes taken by walking students and those driving or being driven to school. Identifying acceptable levels of negative impacts or desirable levels for positive interactions will often require a detailed breakdown of the user types; for highways it may be autos and trucks; for schools it may be necessary to recognize differences between age groups, students and staff, and those who walk or drive, in order to apply appropriate measures of impact or to properly plan for mitigation.

The case studies indicated that the users who were identified as being affected by a proposed or existing facility were most often those who complained or protested, particularly school users. This process is changing with the relatively recent mandate for incorporating an environmental assessment process into the planning of federally aided highway improvements.

2.4.2 Assignment of Responsibility for Identifying and Measuring Impacts

The possibilities are that this duty could fall on those using or operating the facilities suffering or benefitting from the impact -- usually the schools; or those using or operating the facilities causing the impact -- in most cases the highway department.

The case studies show that the allocation of responsibility becomes a significant issue any time the institution which experiences a negative impact is not then also responsible for or capable of measuring it for the purposes of planning mitigation measures. Note that measuring impacts also means projecting and estimating them in situations where one or both facilities are not yet in operation. The reason this split often occurs is that the facility suffering a negative impact (usually the school) has neither the funds nor staffing to mitigate it. This was often the case with highway noise impacts. The schools usually had neither the staff to plan mitigation nor the funds to hire consultants to perform the service. In many of the case studies, the school was therefore powerless to present an adequate argument for funds to mitigate the impacts because they were unable to provide "hard," quantitative data to support their complaints. This pattern has been modified in some recent instances by federally mandated environmental assessment procedures. In California, the Los Angeles School District has embarked on its own measurement program in order to support its suit against the Los Angeles Airport for aid in mitigating airport-related aircraft noise.

Theoretically, the schools have the opportunity to identify and roughly project the pedestrian and vehicle safety impacts associated with the operations of new schools. District staff or their consultants should be able to understand the implications of alternative school site locations and site plans for the relative safety of the walk-to-school, drive-to-school, and the impacts of the new school on traffic acjacent to the site. Many of the situations studied, particularly Del Norte High School, indicate that this has not always been the case. These pedestrian and vehicle circulation and safety issues appear to have had a low priority during planning; the impacts were not projected, and School Districts found themselves powerless to correct the problem once the facility was in operation.

The lack of careful study on the part of both highway and school planners in projecting the impacts of their new facility was borne out by many respondents' plaintive cry: "if they had only asked us." Inter-agency consulting and coordination was usually weak when many of the facilities studied were being planned. Even in those situations where coordination is now required as part of the environmental assessment process, it is usually pro forma. The result has been that the users of existing facilities (either schools or highways) and the staff responsible for operations have rarely been consulted early enough in the planning process or in sufficient depth to enable them to fully communicate their knowledge of the nature and extent of possible impacts. It should also be noted that one of the criteria used in the selection of case studies was impact and the sample is therefore biased.

The lack of coordination between those experiencing an impact and those measuring it is often exacerbated because school users and operating personnel do not understand the implications of the measurement techniques and standards used by highway operations staff and are therefore unable to give informed guidance or consent to the proposed mitigation measures which result. The reason may be that the agencies given the responsibility for identifying and measuring impacts, usually highway departments, have missions and agendas substantially different from those whom the measurements are meant to benefit. There is no motivation, therefore, for these agencies to make laymen aware of the implications for them of the measurement techniques used or their results. Measurement standards and techniques are discussed further in the next section.

2.4.3 Choice of Impact Standards and Measurement Techniques

What level or intensity of a particular impact is tolerable for the normal expected use of a highway or school? This question must be answered whenever there is an attempt to plan the construction of a new facility or the improvement of one presently existing once there is an awareness that negative impacts may be involved. As discussed in the sections covering noise and air pollution impacts, there is no agreement on the acceptable levels even for a relatively easy to measure and predictable problem such as noise.

Should noise be measured in terms of levels not exceeded more than ten percent of the time (the L_{10} standard used for evaluating noise impacts of federally aided highway projects) or should the maximum be defined as a peak, the standard used by the California School noise program? What level is acceptable; 55 dBA L_{10} (federal), 50 dBA peak (California), or some other interior noise level? Should there be an exterior maximum; if so, is the federal 70 dBA L_{10} standard appropriate? Are these standards universally applicable to all students, even those with language or learning disabilities? Are they applicable to all types of school interiors; those with soft or hard interior finishes, those with separate classrooms and those schools with open plans?

An equivalent range of questions remains unanswered for air pollution. Which pollutants are most harmful, what levels are acceptable, how often may acceptable maximums occur, what are the sensitivities of different types of students and different types of student activities?

It appears that it may be most appropriate to negotiate the acceptable levels of most other impacts on a case by case basis. Users in large cities, for example, tend to perceive traffic congestion as a problem only when actual traffic delays are experienced. In less dense settings, minor traffic slow downs are perceived to be congestion impacts. There appear to be significant differences in the distances which school districts expect students to walk before the district will assume the burden of providing busing. Los Angeles uses an actual walking distance of one-half mile, Texas uses a straight airline distance of two miles for the same elementary school age groups. Do varying local standards imply that those responsible for highway planning and design must assess a project by local thresholds, or should overall impacts on the particular users involved be the primary consideration? Other impacts which the case studies showed as negotiable in each case included pedestrian safety, traffic interference, and fiscal and land-use impacts. The fact that the acceptable levels of negative impacts may often have to be determined through negotiations between those planning the facility which will result in a negative impact and those who will be affected by it, further emphasizes the importance of presenting impact data in a non-abstract form.

2.4.4 Differences in Agency Goals

The differences in the various participants' view of the purpose of the planning process and their expectations for its product are, to a great extent, the result of the differences in the kinds of projects each has an ability to implement -- the agency's mission. School users, for example, have the goal of making all aspects of the educational process as comfortable and safe as possible; yet individual schools, except those which are private, have no resources with which to implement mitigation measures and no mandate to do so. School districts would like to have the best school environments possible, but mitigation of highway-related impacts at individual schools is usually a very low priority item on the budget. Highway operating agencies see the effects of their locational and operating decisions on schools as having relatively minor significance in comparison to their primary mission, providing for the safe and efficient movement of people and vehicles. Due to recent changes in the regulations of the Federal-Aid Highway Program, and at least in California, the enactment of the School Noise Abatement Program (see Appendix), highway operating and planning agencies have the best access to funding for planning and implementing the mitigation of impacts on schools.

2.4.5 Long Planning Times and Changing Participants

In case studies 4, 6, and 10, the process of planning for either new highways or measures to mitigate existing impacts extended over a period of years instead of months. The long stretch between initiation and implementation is typically caused by a lack of the state funds needed to construct planned facilities. It has several consequences, a major effect being that often the personnel, and personalities, involved on all sides change during this period and cause shifts in planning priorities for the agencies which these people represent. Relationships based upon trust and mutual respect, characterized by an open flow of information, are often terminated by personnel turnover and each new participant may at first want to challenge or re-do the work of his or her predecessor.

Values and relative political power can also change during the process. The situation at the Rinaldi Street School is a good, typical example of the effects of the increasing environmental awareness and diminishing funding of highway projects. These changes lead to greater expectations on the part of school users with respect to mitigation measures and decreased resources available to highway planners. The result can be a planning stalemate which is only broken by a court battle, intensive lobbying, or eventual frustration and apathy, usually on the part of school users. This is because although students' parents are politically the schools' most powerful constituency, parent leadership tends to change as their children move from school to school. On the other hand, in several cases, the extensions of time available for planning have allowed the products to become much more refined and to reflect a wider range of inputs than they would have if the project had proceeded under time constraints.

2.4.6 Proposal and Evaluation of Alternative Plans

Differences in the basic goals of the agencies responsible for planning and implementing highway impact mitigation or avoidance measures (typically highway-related agencies) and those representing the institutions intended to benefit from the products of this planning (the schools) lead to conflicts over the range of alternatives which should be explored in the planning process. School users were often unsatisfied with the alternatives presented by the highway planners, but found that they lacked the capacity to generate other alternatives. In several cases, school users described the difficulty of securing independent expert technical assistance to help them evaluate the alternatives presented and to generate other alternatives. At some point in the process, some highway planners shift the burden of proof with respect to an even wider range of alternatives to the users. School districts rarely have the funds (and sometimes lack the commitment) to explore further alternatives and the parents and staffs at the school in question have neither the funds to pay for help, nor do they often have the leadership to secure volunteer technical assistance. Parents at Rinaldi Street School in Los Angeles demonstrated the effectiveness of this leadership in securing the aid required.

2.4.7 Use of the Environmental Assessment Process

The National Environmental Policy Act of 1969 (NEPA), and the laws of several states modeled upon it, mandates an environmental assessment process. Information from the assessment process is supposed to be available for use by project designers, those who may be affected by the project and those responsible for final decisions. To the extent that drafts of the Environmental Impact Statement or Report are available in time and are reasonably detailed, particularly with respect to project alternatives, this document can serve as a substitute for independent planning expertise in assisting the school-related community to evaluate the project. The Draft Environmental Impact Statement can also serve as a means by which schools can make their concerns known and suggest possible ameliorative actions, since the Final Environmental Impact Statement must include and respond to all comments received during the 45 day public review period.

In the past, these reports have not been prepared early enough in the planning process, nor have they contained adequate discussions of alternatives to provide this function because the projection and analysis of potential impacts and the preparation of draft reports has lagged behind the facility design. Critics contend this has deprived planners of the benefit of the information gathered and likewise has deprived the impacted community of information which could be used in evaluating preliminary design alternatives. Discussion of project alternatives for new highway construction or improvements has also been less than adequate and has tended to be presented in final form long after a commitment to one alternative has been made. The result has been a substantial burden upon the impacted community when they attempt to present the arguments for alternative plans. These deficiencies were due in large part to the fact that many projects were past the planning stage prior to the enactment of NEPA. For these earlier projects, NEPA was a retroactive, after the fact requirement. Many of these early Environmental Impact Statements were inadequate. Later Impact Statements have been greatly improved.

2.4.8 Categorical Funding of New Construction and Mitigation Measures

The funding for public capital improvements, including highway and school construction is usually tied to guidelines describing the permissible scope of work, unit costs, planning process, and impacts which may be mitigated. For example, it may only be possible to mitigate specified impacts (noise, loss of property) caused by one type of facility -- usually a state or federally funded highway. This leads to certain anomalies; a school may be impacted by noise from both a federally funded highway and a local street, but funds will only be available to mitigate noise from the highway.

In contrast to the relatively narrow categorization of impacts which may be mitigated through most of the funding programs encountered, there appears to be considerable flexibility in the measures which may be taken once it is determined that a particular situation qualifies for mitigation. Once there is an initial determination of the cost of the least expensive means of reducing a particular impact to an acceptable level, for example, through air conditioning a part of a school, it has been possible to have this money applied towards the cost of more drastic measures, including moving or reconstructing the entire building. For example, at Rinaldi School, the cost of highway right-of-way acquisition, a freeway retaining wall along the site, and proposed mitigation measures (noise wall and air conditioning) will be used to pay a portion of the cost of moving the school building to another site. In the right circumstances, this flexibility has enabled school districts to use the contribution for the mitigation of a highway-related impact to supplement other funds and pay for improvements which mitigate a number of other impacts.

3.0 FINDINGS: HIGHWAY IMPACTS ON SCHOOLS

3.0 FINDINGS: HIGHWAY IMPACTS ON SCHOOLS

This section delineates the impacts which streets and highways have on schools located in close proximity to them. The impacts identified are those which were reported by school and highway planners, users and other individuals interviewed during the preparation of the case studies. To facilitate a thorough understanding of each impact and its relationship to the school highway situation, the discussion of each impact has been organized into the following categories:

- Impact -- Delineates the impact factor.
- Effects -- Specifies the effect the impact has on school/highway operations.
- Relative Sensitivity to Impact -- Identifies those factors which the case studies indicate determine the magnitude of an impact's effects.
- Mitigating Measures (for Negative Impacts Only) -- Describes the measures which have been used both successfully and unsuccessfully to reduce the effects of each impact.

The positive impacts of highways on schools are described in Section 3.1, the negative impacts in Section 3.2.

3.1 Positive Impacts of Highways on Schools

3.1.1 Vehicular Accessibility

The schools in several cases (1, 2, 12, 21, 23, 24) benefitted from their proximity to regional highways. In some instances, the effect of this positive impact appeared to outweigh negative proximity impacts, and in two cases (2, 9) proximity to the highway was a major reason for choosing the school site.

Effects

Increased accessibility by definition means reduced distance and/or travel time required for the trip between home and school. The primary effect of increased accessibility is to increase the potential size of the attendance service area of the school by reducing the necessary travel time.

Factors Influencing Relative Sensitivity to Impact

The relative size of the school's attendance service area which, in turn, determines the number of students who come to school by car or bus is the most important factor in determining the degree of positive effect a highway will have. Service area size generally increases with school size; high schools and colleges experience the greatest benefits, while there is usually little positive impact for elementary schools. All types of private schools appear to benefit from proximity to regional highways unless they are very small neighborhood oriented facilities, such as day care centers, or are boarding schools which generate little daily traffic.

3.

3.1.2 Increased Visibility from the Road

Respondents at one school (2), a private school with a large percentage of day students, indicated that the visibility of the school from the major highway nearby was a significant positive proximity impact. The visibility of the school was seen as a form of advertisement, particularly as the highway was heavily used by the upper-middle income parents who were the primary source of the school's enrollment.

3.1.3 Enhanced Pedestrian Accessibility

New highway construction or major improvements are often designed with sidewalks or pedestrian overpasses which increase pedestrian accessibility by bridging the barriers created by earlier highway construction (case 7). This occurs when traffic increases on an existing highway have made pedestrian crossings unsafe, or where the highway is no longer an attendance area boundary and it becomes necessary for a significant number of students to cross it.

3.2 Negative Impacts of Highways on Schools

3.2.1 Noise

Highway-related noise was by far the most often mentioned negative impact and the one which appears to cause the greatest disruption of normal school functions. This report does not attempt to review the significant quantity of technical literature available on noise measurement and impacts. The focus is rather upon the aspects of noise impacts which are peculiar to school situations, some of which remain technically unresolved.

The major sources of highway noise are truck traffic and general tire noise on limited access highways and truck traffic and emergency vehicles on local streets and arterial highways. Truck noise can be divided into tire, engine and exhaust noise. The latter being the primary source of disruption as reported by the greatest number of respondents. The other major source of highway-related noise is highway construction, which was mentioned as highly disruptive in the limited number of situations where it occurred.

TABLE 2

IMPACTS OF HIGHWAYS ON SCHOOLS

Impact	Effect	Factors Influencing Sensitivity	Mitigating Measures	Case Study Identifier
Noise	• Speech interference • Hearing interference • Aggressive behavior	• First language of children • Hearing acuity of children • Spatial relation between school/source of noise • Highway configuration • School site plan • School building design • Climate	• Noise barriers: walls, berms, landscaping • Sealing openings and air-conditioning • Depression of roadway • Building and site plans • Building materials	3, 4, 5, 6, 10, 12, 13, 15, 16, 18, 22, 23, 24
Pedestrian Safety	• Accidents • Anxiety • Parent-Teacher Community Organization	• Age of children • Spatial relationship of school and highway • Traffic type/speed/volume	• Grade-separated pedestrian facilities • Traffic control devices • Crossing guards • Busing program • Physical constraints • Safety education program	3, 4, 7, 8, 10, 16, 17, 18, 19, 20, 21, 24
Air Pollution	• Physical discomfort; headaches, nausea, sore throats • Limited outdoor play/exercise time • Decreased athletic performance	• Ambient pollution levels • Proximity and wind patterns • Method of school building ventilation • Pupil type • Activity type	• Depression of roadway • Airconditioning • Restrictions on pupil activities	3, 4, 24

Impact	Effect	Factors Influencing Sensitivity	Mitigating Measures	Case Study Identifier
Access	• Lengthen pedestrian distance to school • Isolation of school from service area • Decrease vehicular and pedestrian traffic safety • Changes in school useage	• Type of school • Availability of alternative transportation modes	• Pedestrian over/under passes • Signalization • Signing	3, 7, 8, 9, 10, 13, 14, 16, 18, 23, 24
Changes in Service Area	• School closings • Changes in school useage • Reduced attendance	• Type of school • Type of financial support	• Land swaps with Highway Department • Route location	5, 8, 14, 17, 22
Visual Distraction	• Student inattentiveness	• Type of school • School building design	• Landscaping • Site design	3, 7, 23, 24

A number of other miscellaneous factors add to the impact of highway-related noise at schools. A nearby fire station or hospital will serve to generate emergency vehicle traffic whose sirens distract younger pupils and interrupt classroom discussion for any age group. Grades on nearby limited access highways can be a source of significantly increased truck noise related to the additional engine strain. The same situation is often created by nearby on- or off-ramps. The presence of traffic control devices (such as signals or stop signs) located adjacent to schools on streets or highways which carry an appreciable amount of truck traffic will increase the noise impact, due to the acceleration and deceleration of the trucks.

Effects

The nature of the teaching/learning process makes unwanted noise a serious interference. By far the greatest proportion of time, both within the classroom and outdoors on the playfields, is devoted to verbal communication; this is true for all age levels. There are some minor exceptions, such as in the use of gymnasiums and vocational shops, but even in these settings, unwanted noise from external sources can present problems at those times where there is group instruction.

The present Federal Highway Administration noise standards establish the maximum exterior design noise level for activity category B (which includes residences, recreation areas, and schools) to be an L_{10} level of 70 dBA. Furthermore, these standards set the interior noise level guideline for the same category at a maximum of 55 dBA (L_{10}). In California, however, the state's standard calls for an interior peak noise level of 45 dBA in school classrooms. Although unsupported by any quantitative measurements in the case studies, respondents indicated that, in general, the level of unacceptable noise was that which interfered with the level of conversation typically appropriate for the particular setting. In other words, a lower level of peak noise may affect an interior teaching space in which the users expect to use a normal conversational voice, while somewhat higher levels may be acceptable on the playground.

In those case studies in which noise impacts were noted, peak noise occurrences, such as the acceleration of a truck or the passing of an emergency vehicle, were always found to be very distracting and were mentioned as a significant source of interference (even when there were relatively infrequent occurrences of once or twice a day). The distraction experienced lasts longer than its cause. The five or ten second passage of an emergency vehicle could lead to five or ten minutes of distracted student behavior.

Several respondents mentioned other perceived side effects of the noise impact which are related to the behavior of school children. For example, teachers in several of the schools observed that elementary pupils appeared to be more aggressive in their behavior and generally unruly because of the apparent strain of having to continuously communicate with each other over the din. This effect was believed to be more pronounced among pupils on the playground than among those in the classroom. These observations are clearly unscientific and the behavior observed could well be influenced by a variety of other factors, but the apparent connection between behavior and ambient noise is plausible and deserves further investigation.

Another aspect of the effects of noise impacts, which deserves further investigation, is the relative sensitivity of pupils whose first language is not English to distraction and interference from extraneous noise as compared to the sensitivity of these pupils whose first language is the one being used in the classroom. Several respondents reported that students whose native language is not English were substantially more affected by highway noise because it makes it more difficult for them to clearly distinguish spoken words. Fluent English speaking students are able to "understand" even when portions of the message are unheard, because they are able to interpolate from the context. The student whose understanding is dependent upon hearing each word is more likely to perceive highway noise as a serious disturbance. While these perceptions are not based on scientific measurement, they appear to be quite plausible.

Factors Influencing Relative Sensitivity to Impact

The effect that highway-related noise has upon school users is also a function of a number of extraneous factors which are discussed below. There is substantial literature available with extensive technical discussions about the relationship between these factors and noise transmission; this report addresses only those factors reported by respondents or perceived by school users as most relevant to their situations. Although each factor is discussed separately, in any particular highway/school situation these factors interact and it is difficult to completely isolate their effects.

- Spatial Relationship Between School and Noise Source

The two most basic factors determining the impact of the noise are the loudness of the noise and the distance between the source and the receiver. However, as indicated by the fact that situations in which classrooms are more than 450 feet from the roadway (case 23) were perceived by users to be severely impacted by noise as were classrooms only 25 feet from the street (case 3), other factors affect the users perceived magnitude of the impact. Generally, the effect of distance appeared to be modified by the nature of the intervening space (whether it was landscaped or hard surfaced), by the relative elevations of the school buildings and the roadway noise source, and by the orientation of the school-related receiver.

Landscaping, if sufficiently dense, can reduce the perceived noise level, sometimes to acceptable levels. Hard surfaces which tend to reflect rather than absorb noise increase the perceived noise level.

Because noise travels in a straight line, if the school user or classroom does not directly face the source or is not in line of sight, the noise level is diminished unless the sound is reflected from other hard surfaces which direct it toward the receiver.

The case studies showed once again that these factors typically interact to determine the level of noise experienced in any given situation. The nature of the interaction between the distance separating the receptor and the noise source, their relative heights, and any features located between the two is illustrated in Figure 1 on the following page.

Another aspect of the spatial relationship between the highway and the school which has a significant impact on the intensity of the perceived noise and the relative difficulty of mitigating its effects, is the geometry of the roadway alignment with respect to the school site. In cases 3 and 6, the alignment of the main roadway and/or associated on- and off-ramps was such that objectionable noise came from more than one side of the school, which resulted in more severe noise impact. Figures 2, 3, 4 and 5 illustrate how the geometry of the roadway can affect the noise impacts felt at a nearby school.

- School Site Plan

  The orientation of the school buildings with respect to the highway noise source affects the number of classrooms or other spaces which are impacted by noise. If rectangular structures are oriented such that their short end is parallel to the highway, less surface area (and thus interior space) is directly exposed to the noise source. As illustrated by the case studies, in the past those schools with rectangular forms tended to be situated with their long sides parallel to the roadway (the noise source) because conventional site planning recommended

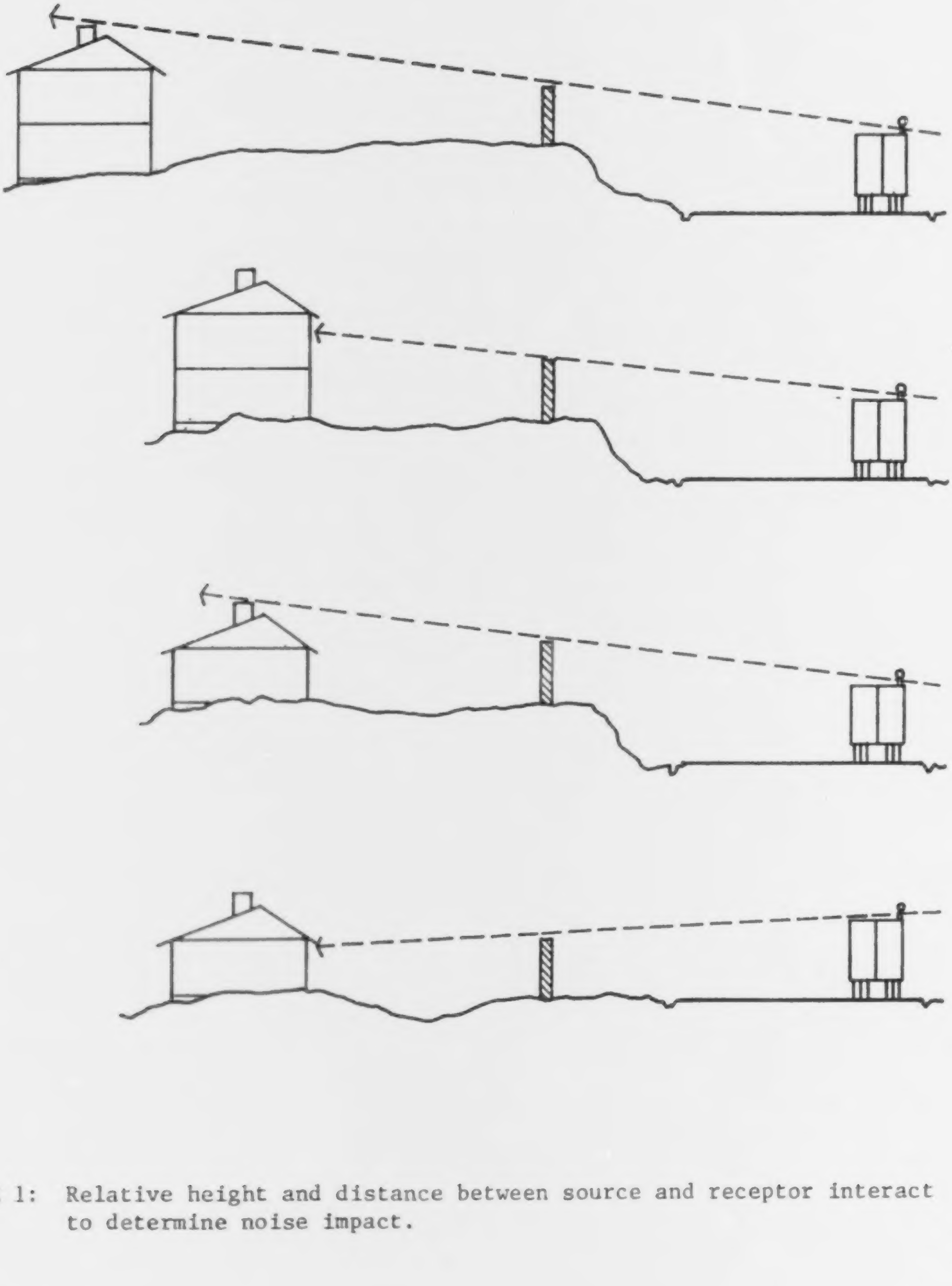


FIGURE 1: Relative height and distance between source and receptor interact to determine noise impact.

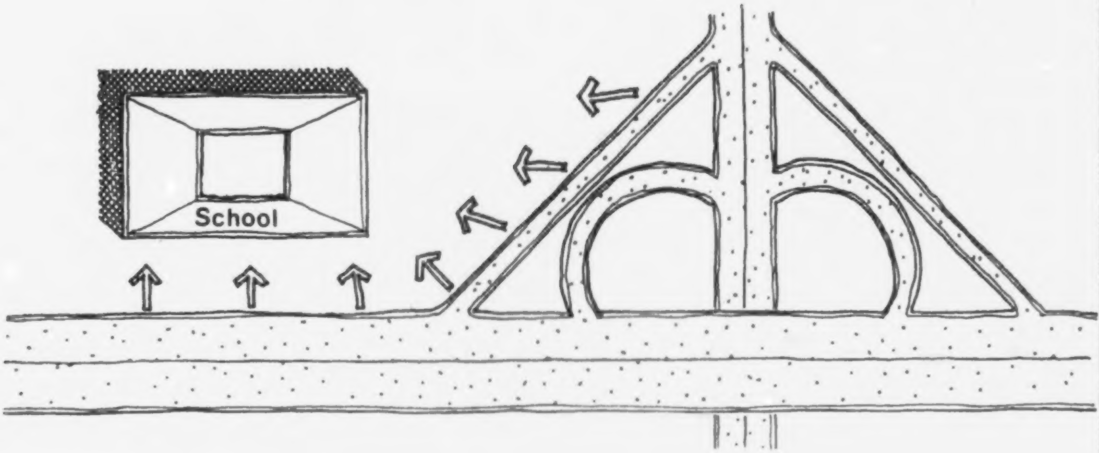


FIGURE 2: Limited access highway ramps may be a major source of noise impact.

that buildings front on and thus define streets. However, a few of the case studies, involving relatively new schools, indicate that the understanding of noise gained in recent years has caused a change in this conventional wisdom and schools are being oriented to minimize noise rather than to define streets. Another school site plan which also can affect the level of the noise impact is the central courtyard plan which can experience unique noise impacts for several reasons. In one such situation (case 6), classrooms oriented around central courtyards proved vulnerable to the noise from the adjacent highway because the highway was elevated and there was no way to prevent the noise from being directed down into the open courtyards.

Noise can also be reflected off hard surfaces of adjacent structures into spaces which do not actually face the noise source.

This problem is most significant in situations where the courtyard concept exists or where the school is laid out in a tightly-packed campus plan.

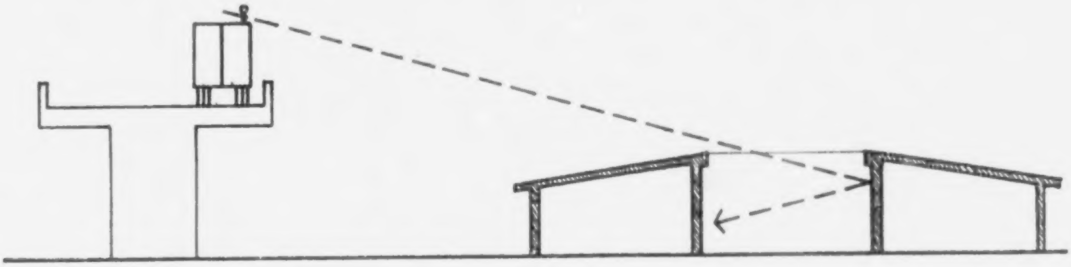


FIGURE 3: Exterior courtyards may increase noise impact because of reflection.

The location of various functional areas on the school site can greatly influence the degree of the noise impact experienced by the school. If a school site is large enough, noise-sensitive functions may be located sufficiently distant from the noise source to ameliorate impact. This was rarely done where a school was located adjacent to both highways and local streets. Parking in these instances was usually located closest to the street, placing the school closer to the noise source, rather than next to the highway, where it would have served as a noise buffer.

- School Building Design

The various aspects of building design which affect the relative impact of noise from external sources such as highways are usually also related to a variety of other factors as well, including regional setting, climate, date of construction, and type of school use. Of foremost significance is the type of ventilation system used, particularly during warm weather.

The type of building construction, either wood frame or masonry, is of relatively minor significance with respect to the effects of noise when compared to either the orientation of classrooms or the means of building ventilation. The type of construction would only appear to become a significant issue when one is contemplating sealing a building against noise or installing air conditioning. Where the peak noise level is reasonably high, a wood frame building may have walls and ceilings which do not have sufficient mass to prevent the infiltration of noise of certain frequencies.

Building height and classroom orientation are obviously important characteristics related to noise impacts. Second story classrooms are subject to impacts which are at least as great and sometimes greater than those at ground level. The seriousness of the noise impact depends significantly on whether or not noise-sensitive activities are conducted in areas of the building directly adjacent to or facing the noise source.

- Climate

This is a factor which is determined by a number of variables and, in turn, determines further variables which have an effect on the extent to which noise from an external source, such as a nearby highway, impacts a school. In schools with windows which can be opened, the climate is obviously the most important factor in determining whether the windows are open, and therefore whether or not users will experience particularly objectionable noise from external sources. In windowless, centrally air-conditioned schools, such as Del Norte High School in Albuquerque, which were not exposed to exterior noise, the climate was the prime determinant of the school's basic design.

Climate is determined by geographic location, by time of year and by time of day. Even in the most extreme warm climates, where recently built schools have been windowless and air conditioned, there are a number of days during the school year which do not require the use of air conditioning for climate modification and natural ventilation is desirable. On these days, the central climate control systems in the schools were claimed to be unsatisfactory by the users, because the systems were not designed for moderate temperatures. The users defeated the effect of the ventilation system on noise insulation by opening exterior doors in order to provide natural ventilation, resulting in highly intrusive exterior noise.

In more temperate climates, most schools rely on natural ventilation during the larger part of the school year when it is not cold enough to keep all windows shut. In the mild climate experienced in such states as California, school users reported occasion to open windows on most days of the school year, and thus these buildings' interiors were even more exposed to noise from external sources. Usually, the time of day will have an impact on inside and outside temperatures and, therefore, on a school building's interior exposure to outside noise. In many parts of the country, mornings are cool enough for windows to be closed, because the buildings have cooled overnight. Thus, the building and related activities will be less exposed to noise at these times.

Mitigation Measures

• Highway Operations

Restrictions on truck traffic were used in one situation initially contacted for this study, although not used as a case. This measure was reported to be highly effective as a means of mitigating highway noise impacts. The restrictions were imposed primarily because a significant portion of the route passed through exclusively residential neighborhoods whose residents had insisted upon the measure before dropping their opposition to the route. These types of truck restrictions would not, however, be feasible on the majority of limited access highways whose locations were chosen, at least in part, to enhance commercial and industrial uses.

• Highway Design

The most extensive experience with the problems of abating the impact of highway-related noise on schools has been gained in California, which has an ongoing state-mandated program administered by its Department of Transportation (see Appendix). This experience indicates that the inherent geometry of roadways depressed in cuts makes it easier to use moderate height soundwalls to contain noise, except where the opposite wall of the cut is vertical, and tends to act as a reflector. In these instances the wall of the cut must be modified to deflect or absorb the noise, or the barrier wall must be increased in height. At one case study site (case 4), a new roadway originally planned to be at grade was depressed in order to mitigate noise impacts.

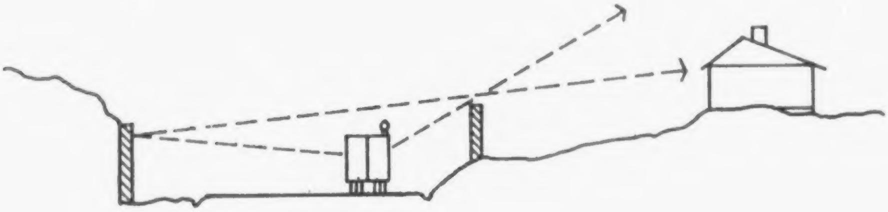


FIGURE 4: The geometry of reflecting surfaces may defeat the effect of sound barriers.

- Noise Barriers

Walls, berms, and landscaping have been used either singly or in combination to reduce the noise emitted by highway operations. Walls or berms were usually required because the maximum noise attenuation possible from dense landscaping is typically 5 dB, which is rarely adequate. Berms were not used in any of the case study situations because of minimum barrier height requirements and inadequate space in either the highway right-of-way or on school grounds. The most desirable location for a sound wall is at the edge of the roadway. In this location the amount of surrounding property which benefits is maximized rather than being restricted to the school grounds. The required wall height varies with the geometry of the particular situation, a function of a variety of factors, including the relative height of the source and receptor, the presence of reflective surfaces on the other side of the roadway, and the relative distance of the wall between source and receptor. The California Department of Transportation school noise abatement program experience indicates that a noise wall will have to be much longer than the school frontage on the highway in order to intercept the line of sight of vehicles until they get far enough away to no longer contribute to the noise reaching the school. Figure 5 illustrates this principal.

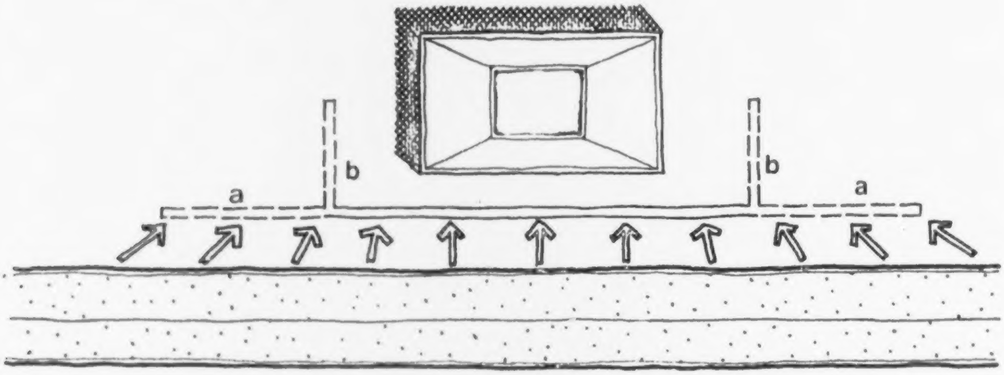


FIGURE 5: Additional lengths (a) are required for soundwalls to adequately control highway noise. Turning the wall ends in, as at (b), can reduce the length of wall required.

In one case situation, small noise barrier walls were built on school grounds to protect those parts of the school building with openable windows. The most consistent complaint about walls was that they tended to be unsightly, and when located on school grounds, they were a source of concern about student supervision because they made it difficult to visually supervise that portion of the school grounds located behind the sound wall.

- School Design: Site and Building Plan

In some case study situations where new schools were constructed adjacent to existing highways, the school site plan was used to mitigate the impact of noise in either of two ways. One was to set the buildings as far as possible away from the noise source, using parking and playfields as buffers. This approach was chosen when the highway noise source and the street used for access to the school were different, and usually on opposite sides of the site. The other approach was to use the school buildings themselves as a buffer for the rest of the school site. School spaces such as offices, gymnasia, auditoria, and cafeterias, which did not require exterior exposures, were located nearest to the noise source, shielding more sensitive spaces such as classrooms.

- School Design: Building Materials

Sound transmission is inversely related to the mass of wall and roof materials. In one case (6), it was necessary to add mass to the roof, even after the school was air conditioned, to achieve desired attenuation. Windows, even when shut, may not provide a sufficient sound barrier and in several cases (6 and 3), it was necessary to fill in window walls with more massive wall materials. This solution is not well received by school users, particularly teachers. Several respondents believed that the installation of carpeting and other sound absorbant materials within classrooms would be a more acceptable solution than this type of structural modification.

Mechanical ventilation and air conditioning, in conjunction with the sealing and caulking of operable windows, and the gasketing of exterior doors, is a relatively common mitigation measure where soundwalls are too costly or otherwise infeasible. As noted above, windows may need to be replaced with solid walls in situations where the attenuation required is greater than 25 decibels. The major problems associated with the use of air conditioning are relatively high operation and maintenance costs, the inability of room occupants to control temperature or air flow, and an unsubstantiated belief that it tends to cause colds and sore throats.

3.2.2 Pedestrian Safety

This is probably the first problem which comes to mind with respect to the interaction of highways and schools, particularly of elementary schools. An extensive study of the safety problems associated with school age pedestrian access to and from schools was recently prepared for the Federal Highway

Administration: School Trip Safety and Urban Play Areas, by Martin Reiss, report number FWHA-RD-75-104, November 1975. This section will expand upon this earlier study's findings and recommendations within the context of the case study situations studied.

Effects

Pedestrians and vehicles interfere with each other's circulation wherever their routes intersect. The School Trip Safety study indicated that the youngest students (5-8 years) are more likely than the older students (10-14 years) to be involved in school walking trip accidents. The study also found that significantly more of the younger students are unaware of, or do not discriminate between, various traffic control devices; and that they would vary their route to school on the basis of parental instructions to a greater extent than older students.

At many of the case study schools, school officials indicated that pedestrial safety problems were a primary concern. Several of the schools (cases 10, 16 and 18) had experienced accidents involving vehicles and school children pedestrians in which children were seriously injured or killed. These events have had a profound emotional impact upon the school community and have provided a strong impetus for well organized parent and school staff demands for mitigation measures. Even at the schools where no accidents had been reported in recent years, there were expressions of extreme concern indicated both by parents and school staff.

Factors Influencing Relative Sensitivity to Impact

- Student Behavior

  As mentioned in the School Trip Safety report, student age was one of the most important determinants of the likelihood of student pedestrians actually suffering bodily harm from conflicts with traffic on highways adjacent to the school.

  Another major determinant, and one which can more easily be influenced by design, is the spatial relation between the school and the highway. Two typical situations appeared to cause the most trouble. In the first, the school was adjacent to a limited access highway and students were required to cross local streets which carry

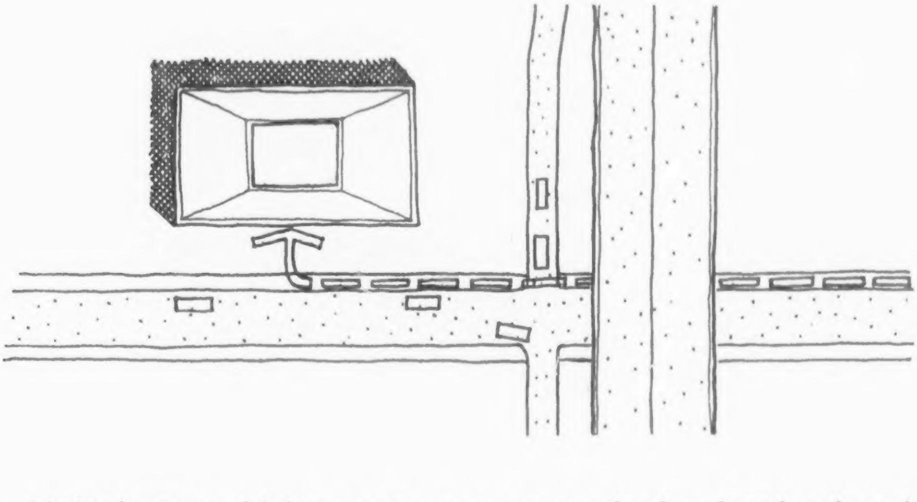


FIGURE 6: Limited access highway ramps can cause school-related pedestrian safety impacts.

traffic to and from interchange ramps or in some cases were required to cross the ramps themselves. In the second type of problem situation, the school was located on a major arterial street and the location of a pedestrian crossing with a traffic signal or crossing guard was far enough from the main entrance of the direct route of travel that students would run across the street at mid-block or at uncontrolled intersections rather than walk the distance to the controlled intersection.

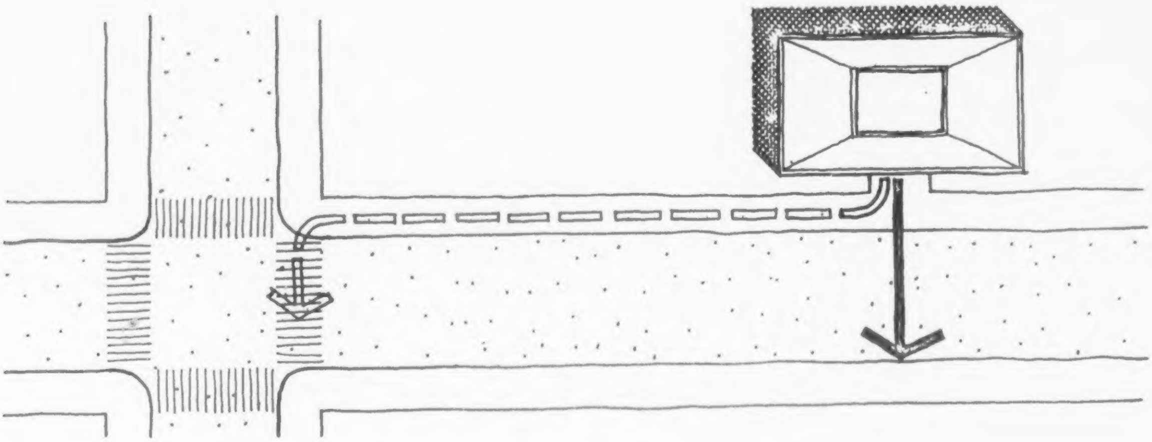


FIGURE 7: Students will not use crosswalks where they are a substantial distance from the school entrance.

In several cases (cases 3, 9, 10 and 16), school staff noted that even when an overpass or pedestrian tunnel is provided, students will often not use the facility unless they are influenced to do so by the presence of an adult monitor or a fence.

- Driver Behavior

  With respect to the factors influencing drivers' behavior, data collected for the School Trip Safety report, and confirmed in studies conducted by the Albuquerque City Traffic Department at Del Norte High School, indicate that: (1) of the drivers who traveled past school crossing warning and/or speed limit signs, approximately two-thirds of those surveyed actually remembered seeing the signs; (2) the type of warning sign most frequently remembered by the drivers passing it on a regular basis was the flashing school speed zone sign; and (3) eighty-five percent of the drivers passing through a school speed zone exceeded the legal speed limit by an overall mean speed of ten miles per hour. These findings suggest that strong, positive traffic controls alone are not totally effective and frequent police monitoring of particularly hazardous situations might help at least a short term.

  The other factors which influence driver behavior in the area of schools are the distractions occurring off the roadway which encourage the driver to take his full attention away from the roadway. The primary examples of school related distractions would be playground activities within the driver's line of vision.

Mitigation Measures

The range of measures used to improve school children's pedestrian safety is broad; some are now standard practices, while the use of others remains unique to individual situations.

- Grade Separated Pedestrian Facilities

One of the more effective means of improving pedestrian safety is to totally separate pedestrians from the vehicular traffic by providing a pedestrian overpass or underpass. Underpasses are no longer encouraged, particularly for use by school children, because they are historically proven to be unsafe and unsanitary. In the case studies of schools where underpasses exist, the underpasses have either been closed completely or are open only during school-use hours because of these problems. In addition, construction of such facilities is usually more expensive than construction of an overpass.

The use of overpasses must be encouraged and controlled. Experience has illustrated that students will not always use the overpass unless their use is controlled by a fence cutting off access to the street or by adult guards or monitors. A typical fenced overpass costs approximately $200,000-250,000 today. Although unfenced overpasses may introduce safety hazards to passing motorists (i.e., thrown objects) they have proven to be nearly free of criminal assaults and tend to be much more sanitary than underpasses.

- Traffic Control Devices

Traffic control devices are those instruments which traffic engineers use to inform, advise and regulate traffic. These devices principally include signals, signs and pavement markings. Their use and installation is directed by guidelines outlined in the Manual on Uniform Traffic Control Devices (MUTCD); their application as related to schools is described in a chapter entitled "Traffic Controls for School Areas." The devices discussed herein have been utilized at schools represented by the case studies.

1. Traffic Signals: The primary purpose of traffic signals is to control the flow of traffic through an intersection or roadway junction. They are usually located on the basis of minimum warrants established nationally, most often related to traffic volumes; however, one of the warrants does relate to the level of auto-pedestrian conflict. Many school and traffic planners take advantage of these signal installations by locating their designated school crossings at these intersections, thereby providing the children with controlled gaps in the traffic flow.

   Certain signal equipment improvements can be made to improve safety at these crossings. For instance, the Denver Traffic Engineering Department has a policy of installing 12-inch red indications (instead of the usual 8-inch indications) on all signals located at intersections where school crossings occur. This policy is based upon the belief that the larger indication reduces the chance of motorists driving through a red signal due to poor visibility. In addition, separate pedestrian indications are often used at school crossings in the belief that their guidance is more readily comprehended by school-age children.

In at least one case study (case 17), signals were used to control traffic at a mid-block crosswalk. The crosswalk represented a significant crossing between a home for children and an elementary school and open field. The signal installation is operated by pedestrian-actuated buttons, and, thus, only stops traffic when pedestrians are present.

2. Warning Signs: The MUTCD provides for the use of school advance and school crossing signs. School advance signs are used in advance of locations where school buildings or grounds are adjacent to the highway and in advance of established school crossings. Its purpose is to warn motorists that school children may be present on the roadway ahead.

   The school crossing sign is nearly identical to the advance sign and is posted on the crosswalk. Its main purpose is simply to better define the crosswalk.

   Although the usual placement of these signs is along the right side of the road, the Denver Traffic Engineering Department has found it to be beneficial to provide additional signs on divided arterials (case 17). In such situations, two signs per approach will be used: one on the right side of the street and another on the left side in the median.

3. Speed Limits: Reduced speed zones in the vicinity of schools have been frequently used in an attempt to improve

pedestrian safety, but the success of such controls has been rather limited. Even in situations where a flashing amber signal is used in conjunction with the school speed limit sign, the obedience to the speed limit has been poor. As pointed out in the School Trip Safety report, although the speed limit sign with flashing signals is the most noticed and remembered warning sign by motorists, large percentages of motorists continue to exceed the posted speed limit. This has been supported by independent studies conducted by the Traffic Engineering Department at the Del Norte High School in Albuquerque and by the parent group at Moore Elementary School in Denver.

4. Turn Control Signs: The advent of right-turn-on-red in many states has brought on more consideration of the potential for auto/pedestrian conflicts related to the right-turning movement. In Denver, traffic engineers have installed "No Turn on Red When Children are Present" signs at some intersections with school crossings. There are, however, some doubts about the usefulness of these signs because the only crosswalks which should be occupied when the signal indication is red to the motorist are those walks directly in front of his vehicle. Thus, critics say that visibility should not be a problem and that the signs only add to the visual clutter. Proponents respond, however, that the signs at least provide additional warning to motorists that there is a school crosswalk located at the intersection.

- School Crossing Guards

  The use of adult school crossing guards at busy and hazardous intersections has been successful in improving safety at school children pedestrian crossings. Guards can be provided through a formal program administered by the Police Department or the Traffic Engineering Department of a city, or through the use of school staff members before and after school hours. Crossing guards do not direct traffic in the usual sense of controlling or regulating the flow and movement of vehicles; they are not enforcement officers and are not assigned for the purpose of enforcing traffic laws. Their main purpose is to serve as a safety reminder to the children and to secure obedience from the children to the traffic controls.

- Site Physical Plan

  Several physical guidance considerations have been used at case study schools in attempts to improve pedestrian safety. Fencing along major streets can be used to restrain students from running across streets or highways and direct them to controlled crossing locations. Another consideration to be made (usually in the site and building planning effort) is to locate major entrances to the school so that they do not direct students to major street facilities.

- Safety Education Programs

  Education programs aimed at informing students about traffic and other safety practices have been beneficial. The Denver Public School District has prepared a safety brochure which is distributed at the beginning of the school year to elementary school children. As in Denver, classes on safety practices can be presented to the students on the public address system and teachers can be used to daily remind and instruct students about safety.

- School Hours

  In some situations, primarily those schools at which buses are not used as a means of transport by students, the hours of school operation can be modified slightly to avoid coincidence with peak periods of traffic on adjacent streets. In one case (case 18), school hours were shifted to one-half hour earlier in the day to avoid conflicts between students walking home and afternoon commuter traffic.

3.2.3 Air Pollution

This discussion treats the complex, technical issue of air pollution in a very simplified manner in order to make it accessible to the lay reader. Respondents at many case study schools mentioned air pollution as one of the primary impacts associated with an adjacent highway. The great concern shown was not accompanied by references to either measurable impacts or those which could clearly be attributable to the particular highway. The concern instead appeared to be a more generalized response to a growing awareness that motor vehicles are a major source of pollution and that this pollution is generally harmful. Respondents were unable to actually distinguish between the ambient pollution in their neighborhood or city, and that present in the micro-environment surrounding the school.

Effects

The adverse physical effects of air pollution were graphically described by the respondents of two schools in the Los Angeles area, Soto Street and Rinaldi Street Elementary Schools. Teachers at Soto Street, which is adjacent to the junction of three major freeways, reported suffering headaches and nausea which they attributed to pollution. (Either of two pollutants could have been at fault -- photochemical oxides, which are regional, or carbon monoxide which is site specific.) They reported that it was more intense on the second floor of the school and appeared to worsen as the day progressed. As no air pollution measurements have been taken at the school, it is not possible to determine if the reported effects were the result of certain pollution levels, periods of exposure, or personal sensitivity to a given pollutant. When opposing a proposal to keep the Rinaldi Street School at its present site, which is to have a new freeway built next to it, the parents enlisted the aid of several Los Angeles pediatricians who found recent medical journal articles reporting preliminary findings of inverse correlations between air pollution levels and students' athletic performance.

The dust created by highway construction activities near schools also serves to increase air pollution. With a strong wind blowing from the construction site toward the school (case 9), dust and flying debris can make parts of the playgrounds and other outside areas unusable.

Factors Influencing Relative Impact

- Ambient Pollution Levels

  In none of the case studies were measurements or analyses conducted which specifically related reported impacts to either the nearby highway (carbon monoxide) or the general ambient conditions in the city (photochemical oxides). Instead, the level of concern of respondents about air pollution impacts appeared to be directly related to their perceptions of the general level of air pollution in the city. In Los Angeles, where the awareness of air pollution is very acute, respondents were the most concerned. Another factor which encourages this concern of areawide conditions in the Los Angeles area is that on days when there are declared "smog alerts," the public school district will not allow students to play outdoors.

- Proximity and Wind Pattern

  Programs of precise measurements by the California Department of Transportation indicate that local air pollution levels near a highway may vary significantly with the direction of the wind and the distance from the highway. This appears to be particularly true with lead particles which are heavier than air and therefore drop within relatively short distances from the source.

- Types of School Users

  Some respondents suggested that students who are more typically active, and particularly those who spend more time out of doors, will experience greater impacts.

- School Building Ventilation Technique

  Air conditioning has been proposed by School Districts as a means of mitigating air pollution impacts, although it has little effect on chemical pollutants unless it has been supplemented with special filtration equipment. Respondents at several schools believed that air pollution impacts were resolved in non-air conditioned schools whenever windows were shut.

Mitigation Measures

- Roadway Design

  In one case (case 4), the roadway was depressed with the result that air pollution was "trapped" in the alignment trench, reducing air pollutant impact on the adjacent school. Preliminary studies made in the Los Angeles area indicate that depression of the roadway may restrict the spread of heavier pollutants, such as lead, but may also have the adverse effect of allowing photochemical reactions to take place while pollutants intermingle inside the trench. The pollution thus formed rises in higher concentrations before being diluted and dispersed than would be the case with an at-grade alignment.

- Building Design

  In several cases in the Los Angeles area, air conditioning was considered for the purpose of mitigating air pollution as well as noise impacts. It is likely that the most extreme air pollution impacts on school spaces directly adjacent to highways can be somewhat mitigated through the use of mechanical ventilation with an air intake remote from the source. Ambient pollution, typically photochemical smog, can only be eliminated through the use of special filters not commonly used with commercial air conditioning systems.

- School Site Planning

  Since heavier pollutants such as lead tend to fall out of suspension at relatively short distances from the source of emission and other pollutants tend to become more dispersed and diluted, a school site plan which locates pollution-sensitive activities at the greatest possible distance from the source of pollution is desirable. This was not specifically noted as a goal in any of the case studies, as there were no instances of school planning for air pollution. To the extent that local air pollution impacts are primarily dependent upon wind patterns, there may be no practical mitigation measures once the school site location is established.

- School Operations

  In the Los Angeles area, public school students are not allowed to play outdoors on days with "smog alerts." In the absence of detailed monitoring, it is also not clear whether certain schools should impose these restrictions on days when it would not be necessary for all the schools within the air basin.

3.2.4 School Site Access

As noted earlier, highway construction and operational improvements can have positive impacts on the accessibility of public secondary and most private schools which have a greater percentage of children traveling to school in private cars or buses. With respect to public elementary schools, however, access can be constrained by new highways. That is, the travel time and/or distance was increased.

Effects

The proximity of a highway to a school often has negative effects upon accessibility for school users who do not come in vehicles but instead are pedestrians or bicyclists. Several cases were noted in which a highway or major street facility has formed a physical barrier between the intended school service area and the school itself.

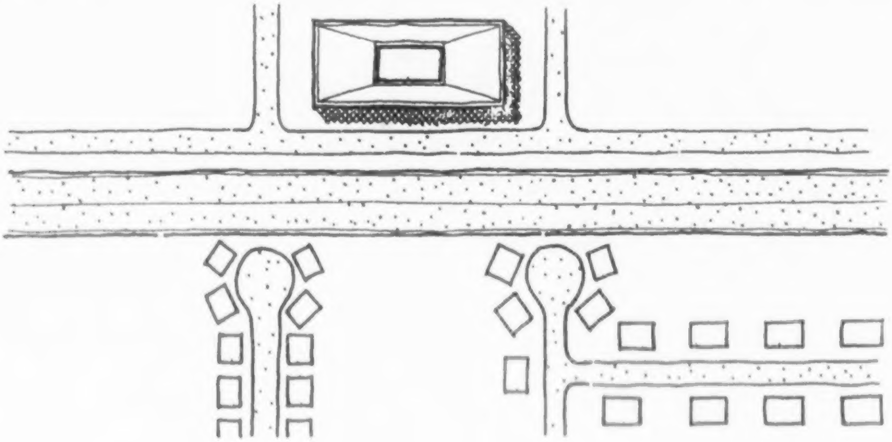


FIGURE 8: Typical negative access impacts of new highway construction.

In the case of the R.P. Harris and Brookline Schools in Houston, the highway was not originally a barrier, but became one as a significant amount of growth occurred on the far side of the highway. The major arterials adjacent to Barrett Elementary School in Denver became barriers when court-ordered integration changed the school attendance area, the boundaries of which were established without due consideration of the major street facilities. The creation of such barriers, in addition to seriously affecting pedestrian safety, often leads to significant additional expense and/or inconvenience by requiring users to walk further and more indirectly to the school or by requiring the use of school buses to provide safe access to and from the neighborhoods isolated by the highway.

Access for pedestrians/bicyclists may be dangerous and inconvenient if adequate means of safely crossing the roadway are not provided and if provisions for movement along the particular street or highway are inadequate. Even major city streets may be impenetrable barriers for younger school pupils unless adequate traffic controls and school crossing guards or grade separations are provided. Sidewalks may be too narrow, they may be located on the roadway, or they may be inadequately protected from accidental invasion by a vehicle.

The increased use of busing by elementary schools implies that those schools located near major streets and highways enjoy enhanced access, at least for those who come from areas beyond the immediate neighborhood and do so in cars or school buses. To the extent that usually at least one-half of the students still walk to these schools, there remains the negative impacts associated with the presence of the major street or highways if the students are required to cross it on the walk to school.

Access for users in vehicles may also be dangerous and less convenient because the highway design provides inadequately for school-related vehicles to enter and leave the site. Examples of this type of negative impact provided in the case studies are numerous (cases 3, 9 and 10). Design defects which cause these impacts may include the absence of adequate traffic control devices, problems of driver visibility from and to the school site, the lack of separate zones for loading/unloading, and no provisions for separate turning lanes to or from the school site. These impacts are mentioned here because they may also be viewed as negative impacts of a school upon the adjacent highway.

Hazardous and inconvenient pedestrian access impacts were reported to accompany highway construction at the St. Thomas Moore School in Virginia and the Brookline School in Houston, and were expected by parents to accompany highway construction originally planned adjacent to the Rinaldi Street School in Los Angeles. At the Rinaldi Street School, the parents were concerned because no special provisions had been made for students crossing the right-of-way during construction; parental concern was exacerbated by the fact that the parents were unable to determine which agency could or should be held responsible for the situation.

Hazards and inconvenience were created by heavy, high speed traffic diverted onto a frontage road during construction of the main, limited access roadway. The students' walk to school required crossing the frontage road, but speed zone and pedestrian crossings on this route were removed to enable it to handle the high volumes of the traffic diverted because of construction. Students were therefore forced to walk much greater distances to reach a place of safe crossing; at neither school did this negative impact appear to have been predicted or provided for by either highway, school or city public works personnel.

Factors Influencing Relative Sensitivity to Impact

The primary factor which seems to influence a school's sensitivity to the negative impacts on access is the type of school, which implies also the group of the students.

Elementary schools have traditionally been neighborhood-oriented and students have walked to the school from homes within an area defined by a radius of one-half to two miles from the school. Highway impacts were usually non-existent in that highways did not interfere with pedestrian and bicycle movements within neighborhoods. However, with changing growth patterns and city-wide school integration programs, elementary schools are, in many places, no longer neighborhood schools. In suburban locations, these schools are usually located in the center of residential neighborhoods, but as the density of development increases, it becomes more common to locate them at the edges, as defined by major streets. Because of the relative youth of the users of these schools, major city streets can effectively inhibit access to the schools unless adequate means of crossing are provided.

Although perceived to be somewhat less severe, the impacts of highways upon secondary schools may still be negative if the roadway acts as a barrier because of inadequate protection for safe crossing by pedestrians and bicyclists. Parents tend to be less concerned about heavy traffic as a barrier to access at these schools because the students are older and presumably more responsible. However, in several secondary school cases (cases 10 and 16), traffic was sufficiently heavy to be viewed as a barrier; that is, students were forced to go out of their way to find a crossing which was adequately controlled or it was deemed necessary to construct a grade-separated pedestrian crossing.

Mitigating Measures

The obvious, ultimate and ideal solution to these access problems is to define the attendance area of the school to exclude students living in neighborhoods which would require them to cross a highway on the way to school. Where a new highway is to be constructed, a route location can sometimes be chosen which avoids bisecting the enrollment service area of a potentially impacted school, thus avoiding many access problems which would otherwise require mitigation through highway design measures.

Although busing is a potential means of mitigating pedestrian access impacts, it may not always be an available alternative. In Texas, for example, the provision of school bus service is limited to only those elementary school students living further than a two mile airline distance from the school. Students living within that radius may be forced to walk considerably further if means of crossing the highway are not provided at convenient locations directly adjacent to the school site. It should be noted, however, that in at least one case study (case 17) busing was made available to students living within the minimum distance of the school because a major arterial street acted as a barrier.

As mentioned previously, grade-separated pedestrian facilities can be used to mitigate access-related impacts of a highway on a school. Pedestrian walkways or sidewalks installed in conjunction with a highway underpass or overpass can also serve to mitigate such impacts. In a number of cases, students used these kinds of facilities to cross major highways along their walk to school. It should be noted that several respondents noted sidewalks adjacent to under- or overpasses which must cross the termini of on- and off-ramps at grade, also constitute a potentially hazardous situation even though they lessen the hazards attendant upon freeway crossings.

Problems with vehicular access to schools were mitigated in several cases by the inclusion of a grade-separated crossing of the highway in the interchange. These grade separations not only help to mitigate negative impacts on access, but they can actually create the positive effect of increasing regional accessibility in the cases of private schools, secondary schools, and colleges.

3.2.5 Fiscal Impact

One of the frequently overlooked negative impacts of highways (primarily new highways) on schools is the fiscal impact. This impact most frequently involves consideration of school district operating cost and revenue changes caused by the highway.

Effects

The significance of a loss in pupils due to the construction or expansion of a major highway is a function of both the magnitude of the loss and the initial circumstances of the school's enrollment.

Although not represented by the case studies, loss of enrollment can sometimes mean a reduction in overcrowding. For other schools, including the Hoxie Avenue School and others along the planned Century City Freeway route in Los Angeles, the taking and demolition of homes only increased the rate at which enrollment has been diminishing. In fact, district officials at one school along the planned route realized that demolition of houses for the highway would cause the loss of enough pupils to allow the school to be closed. With this impact in mind, they requested that the highway planners modify the route alignment so that instead of avoiding the school, it would require the taking of the site for which the school district would receive compensation to be used to improve school facilities at other sites.

Changes in the absolute and relative amounts of revenues available per student represent the other major impact of highway location/land use. Schools in many states now receive a substantial proportion of their revenues from state and federal subventions based on average daily attendance (ADA). Loss of students, caused by highway-related land condemnation and clearance, may cause a net loss of revenues to many school districts which must continue with a heavy burden of fixed expenses for debt service of bonds. It is only when the school is not only emptied because of highway-related takings, but is itself taken, that a school district may find that the compensation is adequate to meet debt retirement costs.

Right-of-way activities related to highway improvements will usually also have an impact upon that portion of school district revenues which are raised by means of property tax assessments. One study of these effects conducted during the planning of the Century Freeway in Los Angeles (Interstate 105 Freeway Design Team Concepts, Gruen Associates, 1970) found that the percentage of assessed value removed by the freeway ranged from 0.01 percent to 9.09 percent for the various districts impacted. Obviously, much depends upon the relative size and wealth of the assessment area as well as the value of the properties removed from the tax rolls. Past studies of the longer term effects of highway location have indicated that over the longer run the location of a highway results in a net fiscal benefit to the area impacted. Many highway-caused fiscal impacts are being mitigated and may well be eliminated in the future as the proportion of school revenues which are independnet of local assessed value continues to increase due to federal and state subventions.

Factors Influencing Relative Sensitivity to Impact

Independent elementary school districts are usually the most sensitive to this impact because their total enrollment is small and tends to come from a relatively small area adjacent to the school. Impact on secondary schools and on Unified School Districts is less because both their attendance and their taxing areas are larger. Thus, the relative percentage of total enrollment impacted will be less. In addition, although certain losses from the tax base will occur, the larger taxing area in unified districts will capture the increase in assessed values which result from the stimulation of industrial and commercial development brought about by a new major highway.

The existing uses of land condemned and cleared for highway improvements will naturally influence the impact felt by an adjacent school in the interaction between changes in tax base and residential pupil yields. If the highway improvements result in a loss of tax revenues from commercial and industrial uses and cause no immediate reduction in students within the school's attendance service area, the district will experience a negative fiscal impact, at least in the short run. If pupil-yielding residences are taken while high assessed value, commercial and industrial uses are left undisturbed, the school district may find itself in an improved financial situation if it is not highly dependent upon per-pupil subventions from higher levels of government.

Mitigation Measures

In situations where the short-term fiscal impact of a new highway location is projected to be negative, two courses of action have been taken. One is to simply absorb the short-term effects with the expectation that typical longer-term impacts on assessed values will be positive as new taxable development occurs.

The other measure used to avoid the short-term negative fiscal impact has been selection of a highway route location which removed proportionately more students than assessed value from the district. This was often the case when highways were located in lower income urban areas. The impetus to use this solution to mitigate negative fiscal impacts of highways is diminishing as a greater portion of school district funding is received by school districts on a per-pupil basis.

4.0 FINDINGS: SCHOOL IMPACTS ON HIGHWAYS

4.0 FINDINGS: SCHOOL IMPACTS ON HIGHWAYS

This chapter identifies and discusses the relatively few impacts which the location and operation of schools have on adjacent highways. The results of the case studies indicated that all of these impacts were negative.

4.1 Negative Impacts of Schools on Highways

4.1.1 Traffic Circulation

Restraint of traffic circulation is the most significant impact ongoing school operations have upon highway operations. Figures 9 and 10 illustrate some of the more frequent impacts and typical mitigation measures.

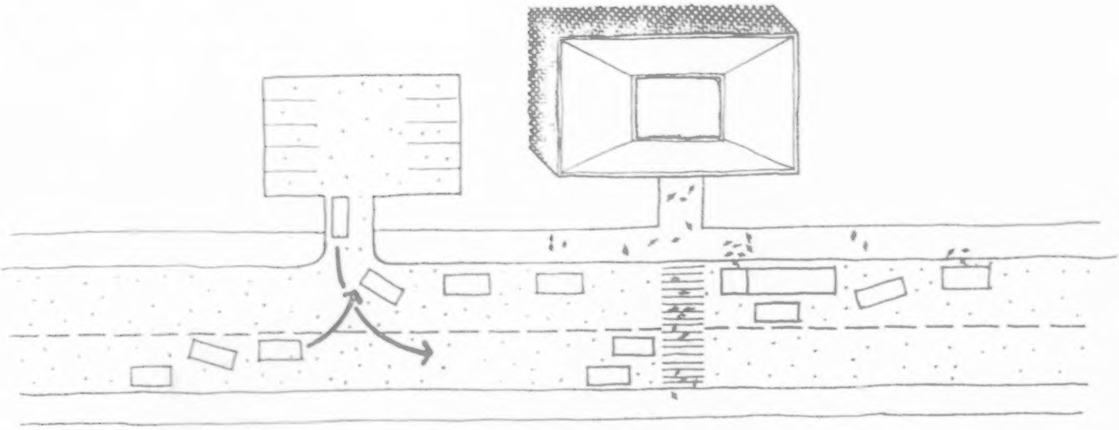


Figure 9: Typical Circulation Impacts caused by School Sites Adjacent to Highways

TABLE 3

IMPACTS OF SCHOOLS ON HIGHWAYS

Impact	Effect	Factors Influencing Sensitivity	Mitigation Measures	Case Study
Circulation	• Congestion • Accidents	• Type of school • Mode of travel -- staff and students • Highway configuration • Time of day	• Traffic control devices • Loading/unloading zones for busing and passenger cars • Separate turning lanes and acceleration/deceleration lanes	10
Vehicular Safety	• Damage to vehicles caused by thrown objects • Accidents • Diminished usefulness of play fields	• Proximity of overpass to school • Number of students using overpass on walk to school • Proximity of play field to roadway • Height of existing fencing	• Fencing of appropriate height around play fields	3, 22, 24

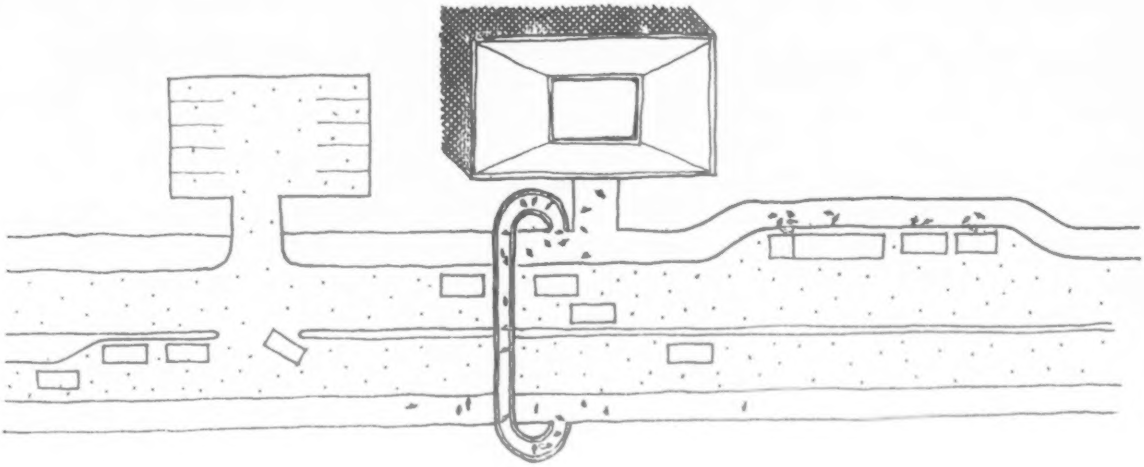


Figure 10: Some Typical Mitigation Measures: Fencing, Lane Channelization, Separate Loading Zones and Grade - Separated Pedestrian Crossings

Effects

The primary effect the presence of the school and its users has is to congest the normal flow of traffic on the streets and highway frontage roads adjacent to certain facilities: loading and unloading zones, heavily used crosswalks, and vehicle entrances to the school site. A secondary impact associated with this congestion is the increased risk of collision between vehicles caused by emergency stops or avoidance maneuvers.

Congestion at school sites resulted from combinations of the following: crosswalk occupancy by students walking to school; vehicles stopping in or outside of loading zones to pick up or drop off students; and the turning movements of vehicles entering or leaving the school site at the beginning and end of the school day.

Factors Influencing Relative Sensitivity to Impact

- Highway Type: Interruptions in traffic flow or congestion due to the proximity of a subject school were experienced on frontage roads and unrestricted access streets and highways in the cases studied. It is probable that even limited access highways would be significantly impacted by the peak hour traffic from an adjacent college.

- School Type: This was a significant variable in the determination of the absolute number of pedestrian and vehicle movements each day associated with school users. Pedestrians involved were students, while the vehicle movements which had a material impact were associated with either, or a combination of, school buses, cars driven by staff or students, and cars stopping to drop off or pick up students. None of the cases gave any indication that significant volumes of commercial vehicle traffic were associated with any type of school.

  - Elementary Schools: Traditional school district planning practice has located elementary schools as closely as possible to the center of gravity of their associated attendance service area which, in turn, was ideally limited in size to a radius no larger than the maximum walking distance expected of children of this age. The theoretical result was that these schools only generated pedestrian traffic, and the few vehicle movements were those associated with staff. Site location emphasized placement in the midst of residential neighborhoods in a manner which did not require students to cross any busy streets on their way to school. The elementary schools studied, which are still in this situation, give no indications of causing congestion on adjacent streets or highways.

However, much has changed in both the physical and educational context of elementary schools, and these changes have caused existing and new schools to have a greater negative impact on adjacent street and highway operations. Busing has increased as a means to help correct racial imbalance within school districts. The center of gravity of attendance areas has also shifted over time with the increasing average age of children in any neighborhood originally developed at one time. Many of these neighborhood elementary schools were constructed with no provision for separate loading lanes for buses or for the peak traffic of parents driving their children to school in inclement weather. Respondents associated with highway operations mentioned the hazards associated with parents chauffeuring their children as being particularly acute because these drivers tend to stop anywhere to pick up their child, even in the middle of traffic lanes.

Secondary Schools: These are much larger than elementary schools and can be the source of greater disruption of local traffic. Because of the increased size of the schools, drawing from larger attendance areas, the use of school buses is greater. Most of these school sites were designed to accommodate some school bus traffic, but in several instances this traffic has overflowed the loading space originally allocated. Interruptions in traffic flow caused by random stops of parents, picking up or dropping off students, can also be a problem, depending on the weather, alternate transportation available, and the traffic volume on the adjacent highway.

Secondary schools also generate significantly higher volumes of staff automobile usage, and in some cases a significant number of students drive to school. At the Del Norte High School in Albuquerque, typical of such suburban schools, approximately 80 staff and 900 students (40 percent of the total) drove to school each day. Highway operations' respondents noted congestion associated with the fact that the stopping and turning movements of this traffic occur within the fairly short periods of time just before and after the school day. School users complained of the congestion and delay encountered at the end of the day, particularly for those vehicles which need to cross several lanes of oncoming traffic in order to make left hand turns. The magnitude of this problem may well have reached a peak and will decline in the foreseeable future as gasoline becomes more expensive and there is further development of public transportation.

Colleges and Universities: There are such great variations in size, function and location context of these facilities that it is not useful to generalize about the quantities and types of pedestrian and vehicle movements which they generate.

Private Schools: Most private schools generate relatively greater volumes of vehicle traffic than public institutions of the same size and type because they draw from larger service areas. The proportion of this traffic which consists of buses as compared to private cars varies from school to school, depending on such factors as whether the school operates a bus service and the availability of public transportation. Traffic congestion caused by individual schools is also a function of the planning of the school site. Those private schools studied tended to be in suburban locations and have large sites which allowed ample provision for buses and parents' cars to stop off the street. In contrast, private schools in urban areas tend to be older and have relatively smaller sites with little or no provision for student loading and unloading.

- Time of Day: School-related traffic causes the greatest congestion on adjacent streets during the morning rush hour, while the impact in the afternoon is negligible. This is because school starting times coincide with the morning commuter peak traffic time, while most schools, except colleges and universities, finish two to three hours before the afternoon commute begins.

  The one traffic-generating activity which may conflict with afternoon school traffic is retail shopping centers, since peak shopping hours coincide with school closing times.

- Regional Setting: This term is used as a descriptor for the relative residential density of the attendance area of the school: urban, suburban or rural. The density of the setting in turn determines other factors which influence the volume and types of traffic generated by school users and the effects of this traffic upon local street or highway congestion. These factors include the percentage of students and staff who live within walking distance of the school and the modal split between the number who use public transportation and those using school buses or cars.

Relative urban densities may also influence the size of the school site and the feasibility of providing for on-site parking and separate loading zones.

Mitigation Measures

- Highway Design

Two roadway design elements have proven to be beneficial in improving vehicle safety and relieving congestion at intersections and driveway entrances related to schools. The first of these is to provide separate turning lanes or bays which allow turning vehicles to move out of the main stream of through traffic while waiting for the opportunity to complete their turning movement. This allows through traffic to continue to flow unimpeded and reduces the potential for rear-end accidents. However, for these special lanes to be effective, they must be designed with a sufficient length to adequately store the vehicle demand placed upon them.

If a major entrance to a school is located along a major arterial street, the use of a deceleration and an acceleration lane can be beneficial. The deceleration lane provides the opportunity for vehicles entering the driveway from the street to transition to the appropriately slower speed without interfering with the speed of through traffic. The acceleration lane provides a facility whereby those vehicles entering the street from a school driveway can accelerate to the speed of vehicles traveling on the street before entering that stream of traffic. Of the two speed transition lanes, the deceleration lane is usually more beneficial because all turning vehicles benefit from the lane; the vehicles using the acceleration lane can remain safely in the driveway until an acceptable gap in through traffic is available.

- Traffic Control Devices

Traffic signals and special features of signals are used to improve vehicle safety and relieve congestion at locations affected by schools. Traffic signals can be located at intersections and school entrances to improve the movement of school traffic with the least disruption to through traffic, but they should be installed only after appropriate traffic engineering studies have been conducted to insure that signals are warranted. In at least one case (case 10), extensive studies showed that the installation of a traffic signal in front of the school was unnecessary and would have caused substantial congestion of morning rush hour traffic if installed in conjunction with a reduced speed zone.

Upgrading of the controller and signal heads to provide separate phasing and indications in turn movements can relieve congestion and improve safety by allowing heavy turning movements to be made unimpeded. The use of traffic-actuated signals at school entrances/exits can be beneficial because they allow for more flexibility than pre-timed signals to adjust to heavy demands during specific time periods. These had not been installed at any of the case study sites.

- Site Plan Considerations

Through the case studies, two site plan elements appear to be important in relation to vehicle safety. A frequently used mitigation measure is the provision of special loading/unloading zones for buses and private autos. The goal of such zones is to separate the stopping vehicles from the through traffic. In some situations, these zones can be effectively located on the site in a manner which totally removes it from the street. In other cases, provision for such zones can be made by constructing a separate lane or bay in the curb adjacent to the outside lane of the street. Where this has not been feasible, due to physical restraints, schools have designated drop-off zones along the curb on minor secondary streets adjacent to the school (case 17).

The location of the parking lot on the school site with driveways along secondary streets may make effective use of existing traffic controls. If they are not located too close to other intersections, vehicular safety in the area may be improved.

4.1.2 Vehicular Safety -- Flying Objects

In a number of cases (cases 3, 22) severe injuries and vehicle collisions were reported to have been caused by objects which were dropped from overpasses by students on their way to or from school. In other cases (cases 3, 24) problems were experienced where school play fields or playgrounds are directly adjacent to highways and enclosed by fencing which was too low to prevent objects such as baseballs from being hit or thrown onto the roadway.

Factors Influencing Relative Sensitivity to Impact

The proximity of pedestrain overpasses to the school was not wholly determinative of the likelihood that students would throw objects from it. Any overpass on the route taken by students walking to school may be a candidate. The types of highways experiencing this impact tend to be those with relatively high volumes of fast moving traffic because these are the roads for which grade separation are provided. These situations are also therefore characterized by the inability of passing motorists to have a timely warning of the specific hazard present or to have the opportunity to easily apprehend a student who has thrown something. The case studies did not indicate that any particular age group was responsible for these hazards.

Baseballs and other objects escaping from school sites presented problems where the play fields were directly adjacent to the fence separating the school from the highway, and the fence itself was not of sufficient height. Low fencing therefore appeared to decrease the usable play area for such activities, and higher fencing appeared to increase it. In one case (case 24) the low fence severely restricted the space available for certain games. Low fencing also presents a supervision problem for school staff (Soto Street School) who are required to monitor and restrict the location of these playground activities.

Mitigation Measures

The case studies indicated two situations in which the use of fencing can improve vehicular safety near schools. Fencing enclosing pedestrian overpasses is very effective in reducing the problem of children throwing objects from the overpass onto vehicles passing below. Secondly, the use of high fencing around play fields adjacent to streets and highways has been effective in eliminating the problem of broken windshields and accidents caused by errant balls.

5.0 RECOMMENDATIONS

5.0 RECOMMENDATIONS

Based on the descriptive information obtained from the twenty-four case studies conducted for this project, as well as from the analyses contained in the preceding chapters of this report, broad recommendations designed to minimize the adverse impact resulting from adjacent highway and school situations have been developed. Each specific recommendation is supported by a brief narrative description of the study's findings related to the issue of concern.

(1) Postulated environmental impacts should be described, both quantitatively and qualitatively, in terms which permit school officials and community groups to fully understand the findings.

Environmental findings, including proposed mitigating measures are often couched in technical language which is not understood by school officials and community groups. For example, "the reduction of noise effects to a level of 65Dba" may define a legitimate and reasonable goal, but it is one which cannot be adequately assessed by those officials or groups responsible for a realistic interpretation of their adequacy. Therefore, the technical language often used to specify various environmental effects should be supplemented with understandable examples of their implications for subsequent design specifications.

(2) The planning process associated with the design of new schools near existing highways should be expanded so as to facilitate inputs of transportation-knowledgeable individuals.

The case studies generally revealed that school facility planning processes often did not provide for the systematic inputs of state highway officials and local traffic engineering and/or transportation staff in the design decision process. In several cases, it was clear that the inclusion of such inputs could have substantially minimized the occurrence of subsequent problems between the new school and existing highway facilities.

The Denver School System's Design Advisory Committee, which reviews plans for new school construction projects, appears to be an effective model for directing relevant inputs from a diverse membership, including school facility planners, city planning staff, highway or city traffic engineers, school staff and administrators, and community representatives.

(3) Responsibility for school-related traffic safety should be assigned appropriate staff in both the schools and highway department; mechanisms should be established to ensure a continuing interface between these individuals.

In several localities, responsibility for the planning and implementation of school-related traffic safety programs is fragmented among several public agencies, including the local traffic and transportation department, the police department, the school district, the city planning department, and, often, various community and neighborhood groups. In addition, traffic safety planning assignments are given to staff or agency representatives whose skills, orientation, and/or level of responsibility are not appropriate to the tasks to be accomplished, further complicating and hindering communication among these groups. Where possible, responsibility for traffic safety programs should be centrally lodged in one public agency, with workable mechanisms established to facilitate inputs from these other groups.

(4) Where state or federal noise impact abatement funds are to be used, the cost-benefit analysis of mitigation measures should include the possible closure or relocation of the school facility.

Cost-benefit analysis to determine the feasibility of various mitigation measures for noise impact abatement often do not include a comparison of total mitigation costs and benefits to those of closure and/or relocation of school facilities. In many cases, other circumstances may render closure/relocation as a viable option, particularly in inner city areas and maturing suburban areas where the demand for public school facilities is declining. In some situations, as in case 4, the absolute costs of these options may, in fact, be lower than those costs associated with noise mitigation, and an analysis of relative benefit should be conducted to determine the appropriateness and feasibility of these options.

(5) School site planning procedures should include the provision of adequate loading/unloading zones for both bus and passenger vehicles which are well-separated from major traffic patterns.

School circulation patterns on sites where inadequate provisions have been made for the loading/unloading of students often have substantial adverse effects on the free flow of traffic along major transportation routes. This is especially true where the school facilities are located near freeway ramps, so that the morning unloading of pupils directly conflicts with commuter freeway traffic. Therefore, site plans for the school facility should include adequate off-street loading and unloading zones. At a minimum, these zones should be located on the street adjacent to the school with the least traffic.

(6) The installation of traffic control devices or provision of roadway improvements should always be preceded by appropriate traffic engineering analyses which determine the nature and extent of the problem and viable solutions.

In several cases, the installation of traffic control devices and/or the provision of roadway improvements (e.g., turn-out lanes) around both existing and new schools was accomplished without a traffic engineering investigation of the circulation and safety problems associated with extant conditions. While school administrators and community groups may appropriately recognize the existence of a traffic circulation and/or safety problem, subsequent demands or lobbying activities for rapid resolution of the problem often lends to the provision of inappropriate and/or unnecessary solutions. Therefore, such requests for improvements should be followed by traffic engineering analyses to systematically determine the nature and extent of the actual problem, and to rationally define appropriate solution strategies.

(7) Special attention should be given to the traffic engineering characteristics and issues associated with suburban high schools; realistic estimates of traffic-generated characteristics of these facilities should be included in the planning of highway improvements.

The analysis of roadway design requirements, determination of optimum circulation patterns, the provision of traffic control devices, and other traffic engineering issues in the vicinity of suburban high schools are often based upon inaccurate estimates of the traffic-generating capacities of these facilities. In many areas, as in the Del Norte High School case study, the proportion of students driving vehicles to the high school is much higher than the norm; in such cases the site plan does not provide adequate parking capacities which results in circulation problems.

(8) In instances where school playground and playfield facilities are adjacent to existing highways, high fences should be provided around such facilities, particularly along those portions of the perimeter directly adjacent to the highway.

Vehicular safety often emerged as a serious problem in cases where school playground and/or playfield facilities were constructed directly adjacent to existing highways. To minimize problems associated with this condition, such playground facilities should be encircled with fencing of adequate height so as to prevent the unintentional throwing of balls or other recreational equipment onto the highway. Similarly, all overpasses over highways used by students who walk to school should be fenced.

(9) Additional research is required regarding the absolute and relative noise sensitivities and resultant impacts in terms of differential school activities, user types and facility characteristics; results of such research should be incorporated into revised standards for predicting noise impacts.

Although the general impacts of noise can be estimated with a reasonable degree of accuracy, the differential effects of such impacts by type of school activity, user, and/or facility have yet to be determined. Additional research focusing on the differential effects of noise impacts should be conducted, and the results of this research should be incorporated into revised standards and procedures for estimating the effects of the various level of noise impact in terms of users, activities, and facilities.

(10) Highway designs providing for the use of depressed roadway sections near school facilities should incorporate measures which mitigate reflective noise impacts.

Depreseed roadway designs near schools have a higher level of noise impact than do roadways at grade, due to the effects of reflected noise. In these cases, side slopes or retaining walls of the roadway cut should be designed so as to minimize noise impact.

(11) For controlled access roadway sections near schools designed at grade, a combination of berms and soundwalls should be required, where feasible, for effective noise mitigation; landscaping techniques should be included to minimize negative visual distraction.

In most areas, the provision of berms and soundwalls on controlled access roadway sections at grade can effectively mitigate noise impacts. To minimize the negative visual effects of such design techniques (distraction to children) , landscaping should be considered. For example, the State of California has developed effective landscaping techniques for at-grade roadway sections which mitigate both visual and noise impacts of highways.

(12) For elevated roadways, adequate provision should be made in the structural design to accommodate the installation of soundwalls.

Elevated roadway sections present substantial noise impacts and effects on school facilities and their users; in cases where elevated sections are located near schools, provisions should be made for the present or future installation of soundwalls to minimize such effects.

(13) The design of roadways near schools should incorporate grade-minimizing techniques to minimize noise effects.

Heavy vehicular traffic moving up grades near school facilities generate substantially higher levels of noise impact than is desirable. Therefore, roadway designs should minimize grades near school sites and facilities.

(14) Freeway interchange designs should include consideration of ramp configurations which maximize spatial separation between the ramp and adjacent or nearby school sites.

Accelerating traffic on freeway ramps, particularly on inclined ramps for elevated highways, generate substantial noise near schools. Interchange designs under such conditions should include consideration of ramp configurations which maximize spatial separation from school sites, and/or include other design techniques which minimize noise impacts.

(15) Where not needed as safety measures for pedestrians, traffic control devices which interrupt traffic flow should be minimized in areas where the highway and/or interchange is located in close proximity to school facilities.

Where possible, interruptions in traffic flow on highways near schools, such as those intended for traffic control or other reasons, should be minimized due to the increased noise impacts of such interruptions. These interruptions increase the frequency and duration of accelerating/decelerating traffic, thereby substantially affecting the noise impacts generated by the highway traffic.

(16) Given the availability of practical alternative routes, diversion of truck traffic from highways near schools should be considered during school hours.

Perceptions of school and highway officials in several areas suggest that the largest portion of noise impacts associated with highways near schools is generated by truck and other heavy vehicular traffic. In those instances where alternative through-traffic routes are available, consideration should be given to restricting truck access during school hours by diverting the traffic to such alternate route(s).

(17) School site planning considerations should include the placement of parking, playground, and instructional facilities so as to achieve maximum buffering of noise-sensitive activities.

In several cases, school site planning activities for new schools near existing highways did not adequately consider the relative noise sensitivities of various school activities and facilities. Those facilities which are more noise-sensitive (e.g., instructional facilities) should be located away from highways and interchanges, using other, less noise-sensitive, facilities (e.g., parking lots) as a buffer. Through adequate consideration of different noise sensitivities, site planning actions and decisions could substantially mitigate the negative effects associated with noise impacts on schools.

(18) School remodeling plans should consider various techniques for noise mitigation, including the installation of air conditioning, caulking and sealing of windows, doubling windows or increasing glass thickness, use of small soundwalls, and in extreme cases as a last resort, filling-in of windows.

A variety of techniques which can be applied during the remodeling of school facilities have been demonstrated to be effective in minimizing noise impacts from highways. The most effective example involves the installation of air conditioning equipment, although various window treatments and the use of interior soundwalls can also significantly dampen highway noise.

(19) Pedestrian grade separations should be incorporated into highway designs only after other safety measures have been shown to be inadequate.

There are a variety of traffic safety measures (e.g., traffic signalization and controls, crossing guards, shuttle buses) which are as effective as pedestrian grade separations in achieving highway safety goals at substantially less cost. Therefore, these alternative measures should be considered before constructing pedestrian grade separations, although significant emphasis must be given to the estimated length of time that such measures or facilities will be needed.

(20) Pedestrian grade separations should, where possible, be overpasses rather than tunnels; positive guidance measures should be considered to ensure utilization of these facilities.

In several cases, the use of tunnels.for pedestrian grade separation has led to increased crime and maintenance problems, and the use of overpasses can mitigate these problems to some extent. Also, the provision of such grade separation facilities does not ensure their use, and school officials should consider the use of positive guidance measures, such as fencing and adult monitors, to minimize disruption of vehicular traffic and traffic safety problems.

(21) For junior high or intermediate schools located near highways, consideration should be given to the use of crossing guards.

Typical practices call for the use of crossing guards at elementary schools only; however, intermediate-level school facilities which are located near highways often experience traffic safety problems resulting in hazards for school students.

(22) State and local student transportation standards should consider the relative pedestrian hazards of the journey to school rather than the absolute distance involved.

Many states and localities establish minimum proximity standards for the journey to school as a condition for the provision of student transportation; for example, in Texas, all students residing more than two miles from their school are entitled to public transportation for the journey to school. In some cases, the area encircling the school facility whose residents do not receive transportation may be bisected by highways which substantially increase the pedestrian hazards associated with the students' journeys. In these instances, school districts should consider modifying the existing standards to permit transportation of affected student populations, particularly for younger children in elementary schools.

(23) School sites and facilities should be designed such that primary pedestrian routes are adjacent to controlled crosswalks.

Traffic safety problems and, to a lesser extent, circulation problems can be minimized if school site plans are prepared so that primary pedestrian routes are located adjacent to, and take advantage of, controlled crosswalks (e.g., signalization, traffic control zones, monitored crosswalks, etc.). In some cases, school site access points do not occur at those places where controlled crosswalks are available, resulting in traffic safety hazards due to pedestrian movements across highways.

(24) As school service boundaries change over time, new highway facilities should be designed so as to permit the future addition of pedestrian and vehicular access facilities.

When new highways are constructed near schools which do not conflict with existing vehicular and/or pedestrian access routes, some consideration should be given to future requirements for access modifications due to changes in the school's service area. Over the long term, changes in demographic distributions of the population residing in the initial service area may require eventual modifications in the size and/or configuration of the service area. Such modifications may alter pedestrian and/or vehicular access routes and patterns which directly conflict with the roadway, resulting in traffic safety and circulation problems.

(25) Estimates of the fiscal impacts associated with the construction of new highways, or major expansions of existing highways, should include an analysis of tax revenues subvented on a per-pupil basis as well as local property tax revenues.

In estimating the negative fiscal impacts associated with the construction of new highways or the expansion of existing ones, lost tax revenues characteristically include ad valorem taxes as a function of decreases in assessed valuations of the construction area. The fiscal impact analyses should also incorporate revenues subvented to the school district from state and/or federal sources on a per-pupil basis, if the construction activity involves the displacement of residential units.

(26) Air conditioning should not be considered a solution to the effects of photochemical pollution.

School planners and designers faced with problemmatical effects of photochemical pollution should not rely on air conditioning as a solution strategy. There is no evidence that regular air conditioning reduces photochemical air pollution. When constructing new schools or air conditioning existing schools, care should be taken to locate air intake as far as possible from the sources of pollution within the immediate vicinity (i.e., highway).

6.0 APPENDIX: STUDY METHODOLOGY

6.0 STUDY METHODOLOGY

6.1 Background and Study Objectives

The impact of highways on adjacent schools and of schools on highways, both positive and negative, have not been systematically examined. The general literature on highway impact focuses upon residential-highway situations (generally perceived as undesirable situations due to noise, view and air pollution), commercial/industrial highway situations (generally perceived as desirable situations due to enhanced visibility and accessibility) and the public fiscal impact of highways on local government (projected to be positive as a result of new or expanded commercial/industrial development along highways).

Schools have generally been assumed to be particularly vulnerable to negative highway impacts such as noise and pedestrian safety. The limited studies which have been undertaken have mentioned a variety of potential impacts: accessibility, tax revenues, land acquisition, noise, and pedestrian safety.

This study of school-highway impacts examines the positive as well as negative impacts of schools upon highways and of highways upon schools. The objective of the study is to:

- Define the local and state decision-making processes that are involved in school and highway location.
- Specify the range and intensity of perceived highway proximity impacts upon the operation of schools.
- Specify the range and intensity of perceived school proximity impacts upon the operation of highways.
- Develop recommendations that will promote the beneficial aspects of school-highway proximity as well as avoid or mitigate negative impacts.

6.2 Study Methodology

The case study was the basis of this research effort. MKGK-AMV compiled a representative universe of 100 situational profiles from which 24 were selected for more intensive case studies. A comparative analysis of the case studies was subsequently undertaken. The results of that analysis are contained in later sections of this report. The paragraphs below summarize the definitions used in the study, the situational variables, and process used to select case study sites, and the procedures and techniques used in preparing the case studies themselves.

Study Definitions

The definitions below served to focus the efforts of the study team in compiling the master list of situational profiles, the selection of case study sites and the preparation and analysis of those case studies.

"Highway" -- The definition of highway originally proposed for this study was a federally assisted road consisting of a minimum of three lanes in either direction. Initial investigation indicated that this definition was too narrow to allow inclusion of a number of such critical and useful situations as, for example, four-lane freeways through rural areas, and major, high volume arterials through urban and suburban areas. The definition was therefore broadened to include four-lane limited access roads, six-lane arterials and collectors, and three- and four-lane urban one-way couplets carrying heavy traffic.

The 114 situational profiles and 24 case studies were prepared using this broadened definition. This revised definition is believed to have enhanced the usefulness of the case studies for federal, state and local policy- and decision-makers.

"School" -- Any type of public or private educational facility providing instruction from elementary through college levels.

"Proximity" -- For the purposes of this study, proximity was defined by school sites and highway rights-of-way which shared a common boundary. Several case studies were included where a local street, or on/off-ramp, separated a limited access highway from the school site. Such sites were included only where it was clear that the highway had had one or more impacts on the school.

"Impact" -- This is defined, for the purposes of the study, as a particular effect initiated or caused by either a school or highway in proximity, which results in a change in one or more of the following areas:

- Noise levels
- Safety, pedestrian or vehicular
- Fiscal Impact, on a city or a school district
- Usage, hours or operation, or scope of services provided
- Accessibility, disruption of functional attendance area boundaries
- Construction or design standards
- Any other area perceived by the users as having been altered as a result of school/highway proximity.

The Situational Profiles

A master list of 114 school-highway situational profiles was compiled from which 25 sites were selected for further analysis. The format of the situational profiles is presented below.

SITUATIONAL PROFILE FORMAT

School

City, State (rural, suburban or urban)
Street
Contact at School
Phone at School

District or Owner name (if private)
Contact name
Contact phone

School type, number of pupils
Date(s) of construction

Highway

Route designation
Name, number of lanes
Type of construction, history, Average daily traffic (ADT)

Proximity relationships: distance, relative height, road characteristics. Adjacency of school/road (on/off ramps, feeder streets, frontage road, special road-related facilities, etc.)

Impacts (as perceived)
Comments

Mitigation Measures
Comments

Sources:
(and data available; indications of willingness to participate)

Information for the master list was gathered using a variety of means. In many instances the process started by using maps and other resources of state highway departments. California, for example, has a highway noise impact abatement program and many situations were selected from program files. In some instances, school district facilities planning offices were contacted for recommendations. Study team files were also used. The initial identification of potential master list situations was followed by telephone inquiries to the particular schools and school districts in order to gather the information required by the master list format, including an initial determination of perceived impacts. It is important to note that these initial contacts provided only a very limited view of perceived impacts in each situation. Further investigation during the case study phase uncovered a greater number of issues or much stronger concerns than were discovered during the process of compiling the master list.

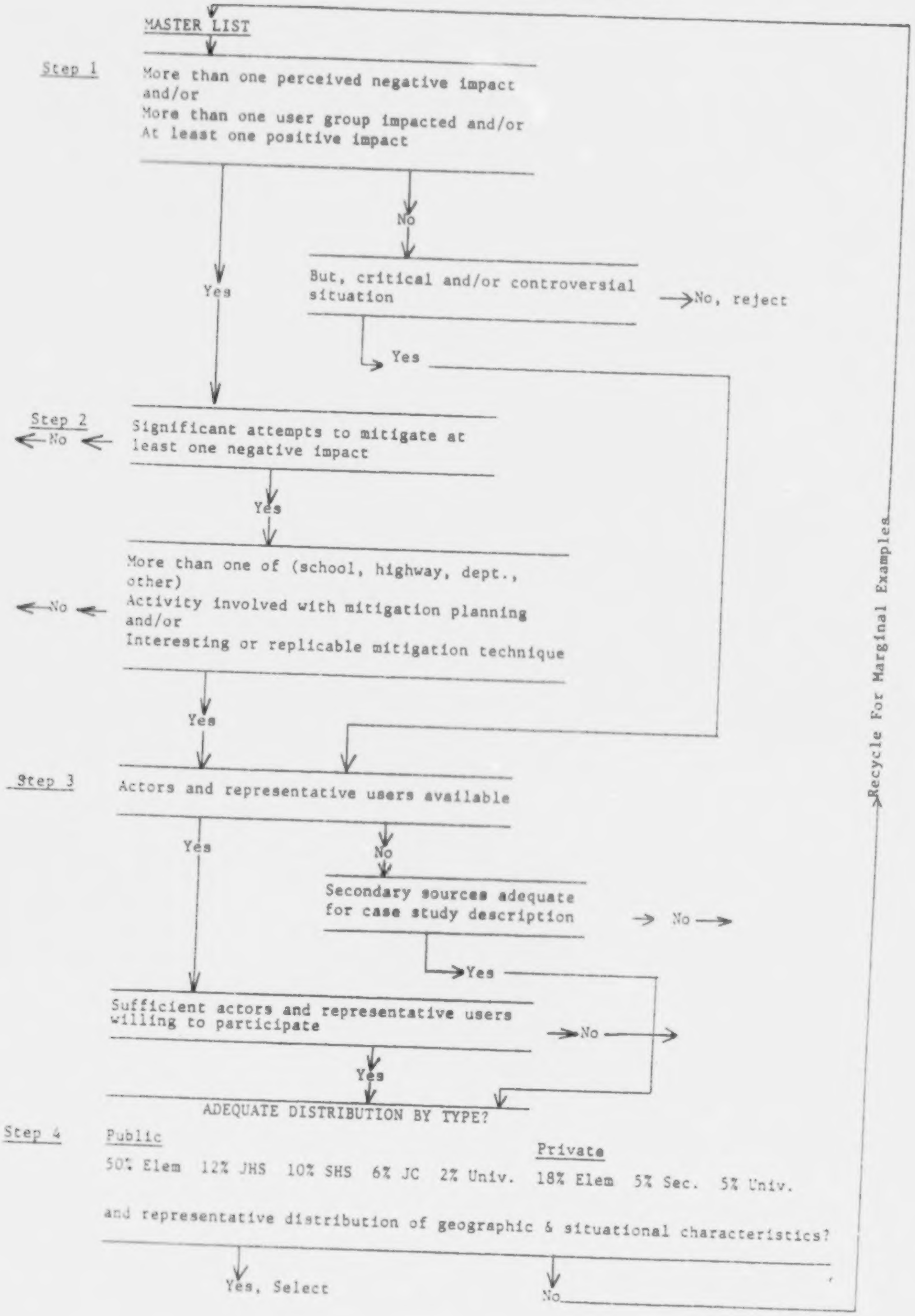
Case Study Selection Process

Case study selection criteria were developed on the basis of the overview which emerged with respect to the range of impacts, mitigation measures, and planning processes identified in compilation of the situational profiles. The process used to select case studies is described in the following paragraphs and is diagramed in Figure A on the following page.

The first step in the screening process was to determine whether a situation was worth studying -- in other words, would examination of the perceived impacts lead to recommendations of ways to take the best advantage of them if they were positive, or the range of useful planning and communication methods and mitigation techniques if they were negative. The first stage in the screening process was intended to eliminate those situations where there is only one perceived impact -- typically, noise, and where there was no other information which led the study team to believe that other factors, such as unresolved controversies or attempts to mitigate at least one negative impact would make a useful case study.

Positive impacts were few enough that the majority of these situations remained as potential case studies sites. Situations were defined as "critical" when negative impacts had caused activities to either cease or be drastically modified. The typical example of a critical situation was a school that had been closed because the taking of land for a new highway right-of-way had reduced the number of pupils in an attendance area, or the situation in which

FIGURE A: CASE STUDY SELECTION PROCESS


MASTER LIST
Step 1
More than one perceived negative impact and/or
More than one user group impacted and/or
At least one positive impact
No
Yes
But, critical and/or controversial situation
No, reject
Yes
Step 2
No
Significant attempts to mitigate at least one negative impact
Yes
No
More than one of (school, highway, dept., other)
Activity involved with mitigation planning and/or
Interesting or replicable mitigation technique
Yes
Step 3
Actors and representative users available
Yes
No
Secondary sources adequate for case study description
No
Yes
Sufficient actors and representative users willing to participate
No
Yes
ADEQUATE DISTRIBUTION BY TYPE?
Step 4
Public
50% Elem 12% JHS 10% SHS 6% JC 2% Univ.
Private
18% Elem 5% Sec. 5% Univ.
and representative distribution of geographic & situational characteristics?
Yes, Select
No
Recycle For Marginal Examples

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there was a new highway being planned, and there was a fear that the school would experience unacceptable levels of disruption in activities due to highway operations.

A few situations were defined as controversial where there was only one major perceived negative impact, again, usually noise, and where either unsatisfied requests for mitigation, or unsatisfactory mitigation measures, had caused controversy between some combination of school users, highway department staff, other political agencies or jurisdictions, and the community at large.

The second step in the screening process was intended to screen out those situations where there had either been no attempt to mitigate any of the negative impacts, and these negative impacts were defined as non-critical or non-controversial by the earlier test, or the mitigation attempt had little significance in terms of its usefulness for a case study. Examples of non-significanct mitigation measures are the plans of the California State Department of Transportation (CALTRANS) to mitigate highway noise by building noise barrier walls on freeways adjacent to schools. As this mitigation technique is easily replicable, it was explored through one case study which also contained other mitigation issues and thus made the case more useful. For this reason, situations where only one institution (school, highway department, local government) had been involved in planning for mitigation were also dropped from further consideration.

The third step was to assure that a case study was possible in terms of the availability of information, both written and through actors (school and highway planners) and users (school students and staff). In some cases, planning for mitigation occurred so far in the past that it was no longer possible to locate major participants. Where there was adequate written documentation, usually in the form of highway department and school district files, they provided an adequate substitute for the availability of the full range of actors originally involved.

In a few instances, potentially important informants expressed an unwillingness to participate in interviews for case studies. In these cases, it was necessary to determine whether other sources of information and other actors could supply enough information for a case study.

The fourth and final step in the screening process was to assure that the case studies which have passed these earlier tests represent an adequate distribution by school type (elementary, secondary, college, public, private), and with respect to the other geographic and situational characteristics (type of highway, year of construction, regional location and the like). Certain trade-offs were necessary to assure that the situations which appear to have potential for highly informative case studies were not de-selected strictly on the basis of distribution. Similarly, if large gaps existed with respect to what were believed to be important geographic or situational characteristics, or school and highway types, it was necessary to select situations which would be more marginal case studies according to the other screening criteria.

Case Study Procedures

The case studies were developed from two to four days of on-site observation and interviewing. The respondents interviewed included:

- School Users
    - -- Operations: School principals, administrators, classroom teachers.
    - -- Planning: District facility planners, architects, long-range planners.
- Highway Personnel
    - -- Planning: State Highway and/or local Transportation Departments, Planning and Design Division personnel.
    - -- Operations: State Highway and/or local Transportation Departments Operation Division personnel.
- Community Groups: Representatives of such groups were interviewed only when school or highway personnel indicated a community group had been significantly involved in the planning or design of either highway-related new construction or mitigation measures.

The instruments used were unstructured open-ended interview topic guides prepared on the basis of the situational profile for each school. This type of survey instrument was selected because it permitted the interviewer sufficient flexibility to pursue local idiosyncracies, perceptions and memories which are not possible when using a highly structured interview format.

While on-site conducting these interviews, field staff collected all available secondary data available on the school and highway -- environmental impact statements, planning studies, maps, correspondence, and the like.

Draft case studies and a Situation Chronology were prepared from these secondary data and interviews. The Chronology was used to assure that the case study was complete and factual. The Chronology and case study were sent to local respondents for review and comment to insure factual accuracy. Their comments were incorporated into the final case studies contained in Volume II of this study.

Contract No. DOT-FH-11-8898

schools located near highways :
PROBLEMS & PROSPECTS

case studies

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Marshall Kaplan, Gans, and Kahn
Alan M. Vorhees and Associates

August 1977

FEDERAL HIGHWAY ADMINISTRATION
DEPARTMENT OF TRANSPORTATION
WASHINGTON, D.C.

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16. Abstract

This report identifies and describes the perceived impacts highways have on adjacent schools and the perceived impacts schools have on adjacent highways. The impacts described include: noise, vehicular and pedestrian safety, air pollution, access, circulation changes in service area, and visual distraction. The study findings and recommendations are based on an analysis of twentytwo case studies in the states of California, New Mexico, Colorado, Texas, Missouri, Maryland, and Virginia. These cases illustrate the range of perceived impacts associated with various types of schoolhighway adjacency situations, the range of mitigation measures utilized to minimize impacts and their relative success.

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INTRODUCTION

Background and Study Objectives

Previous studies of highway impact have not focused upon the impacts of highways on adjacent schools and of schools on highways. It has, however, been generally assumed that schools are particularly vulnerable to negative highway impacts such as noise and pedestrian safety. This study's objective is to identify and describe the impacts associated with school-highway adjacency situations and the mitigation measures used to minimize impact.

This report is based on findings from twenty-four case studies undertaken in six states. The case studies were designed to identify and describe the impacts schools and highways are perceived to have by the users and operators of both facilities. Cost considerations precluded technical noise, air pollution and circulation studies being a part of this effort. It is felt that user perceptions and judgements may be as valid a measure of a highway or school's impact as highly technical graphs of related noise and pollution levels. The table on the following page identifies the school-highway situations studied and presented in the following pages and summarizes the major impacts associated with each.

TABLE 1

CASE STUDY PERCEIVED IMPACT SUMMARY

Schools	Case Study Identifier	Noise	Pedestrian Safety	Air Pollution	Vehicular Safety	Changes in Service Area/Usage	Visual Distraction	Access	Fiscal Impact
L.A. Southwest College	1							4	2
San Diego Military Acad.	2							4	4
Soto Street Elementary	3	3	3	3	2		2		
Rinaldi Street Elementary	4	3	2	2					
Hoxie Ave. Special School	5	3	1			3			3
Fiesta Gardens	6	3	1					1	
Harris	7	1	3		3		3	3	
Dodson	8	1	2	1	2	3		3	
Mt. St. Agnes College	9	1						4	
Del Norte High School	10	2	3	1	2			2	
Hixson Jr. High School	11					1		1	
Visitation Academy	12	3							
McCleur High School	13	3						2	
Goodall Elementary	14					2		2	
Central Inst. Deaf	15	3	1						
Gove Junior High School	16	2	3		3			3	
Barrett Elementary	17		3			2			
Moore	18	3	3					2	
Wyman	19		3					1	
Swansea	20		2	1					
St. Thomas Moore Elem.	21		3						
Cameron Elementary	22	3				2	1		
Baltimore Lutheran High	23	2			2		2	4	
Maiden Choice Elementary	24	3	2	2			3	2	

1 = Minor Impact

2 = Moderate Impact

3 = Severe Impact

4 = Positive Impact

case study background data

school

Los Angeles Southwest College
Los Angeles, California
Los Angeles Community College District

Community College

Present enrollment: 6,000 students
Buildings: Single story converted barracks and trailers. New multistory facility under construction on-site.

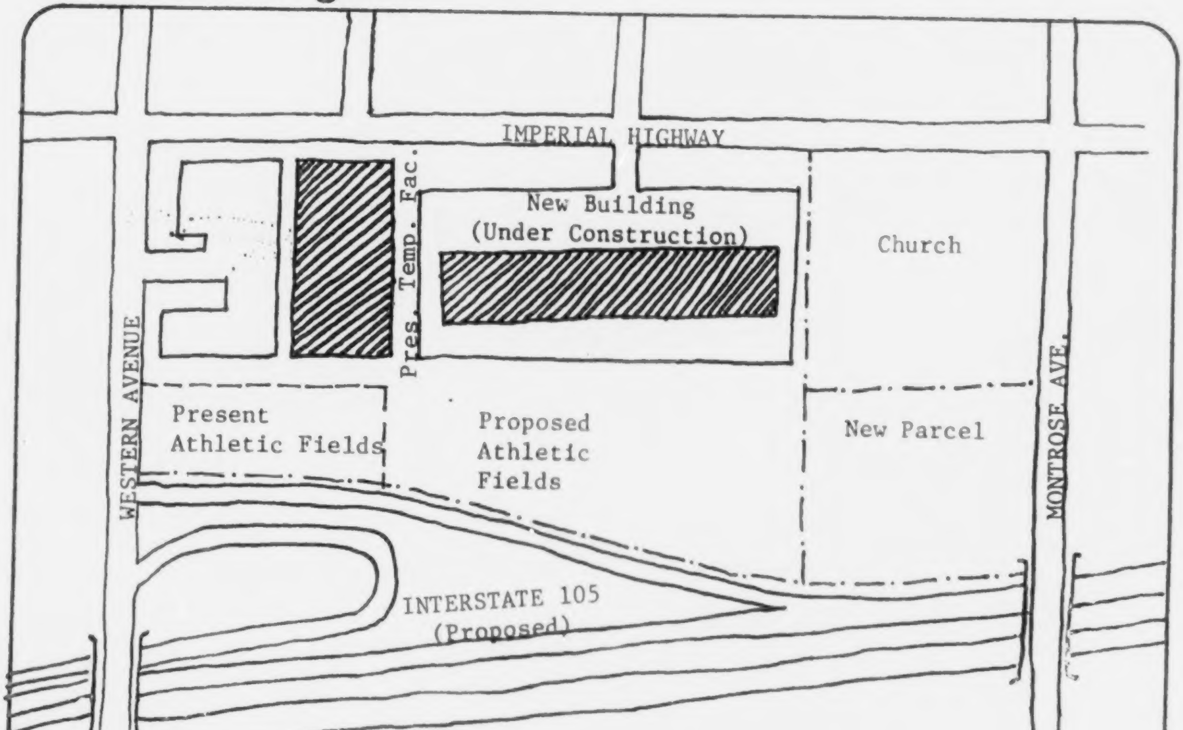
highway

Proposed I-105 (Century) Freeway

Proposed I-105 (Century) freeway and off-ramp.

Eight lanes plus 2 lane off-ramp and partial cloverleaf interchange configuration. Right-of-way oversized to allow for yet-to-be designated future rapid transitway.

situational diagram



I. SITUATIONAL CONTEXT

A. Highway

Interstate Highway 105, or Century Freeway as it is also called, when constructed will provide a west to east link from the Los Angeles International Airport to the San Gabriel River Freeway (I-605) in the City of Norwalk. Extending approximately 17 miles, I-105 will also interconnect nine cities, portions of the County of Los Angeles, and the San Diego, Harbor, and Long Beach Freeways. As presently conceived, I-105 will consist of eight lanes and a 64 foot wide median strip designed to permit a yet to be determined form of rapid transit in the ultimate freeway configuration.

Work on I-105 first began in 1958 when the California Division of Highways, now CalTrans, conducted preliminary route studies. Most work stopped in 1972 when the Center for Law in the Public Interest filed suit in Federal District Court. Among the plaintiffs represented by the Center were the NAACP, the Sierra Club, and, a few months later, the City of Hawthorne. A series of appeals filed by the State ended in 1975 when the U.S. Supreme Court refused to hear the case. Thus, the decision of the lower court with few modifications was left in effect.

In essence, the District Court decision required a formal Environmental Impact Statement (EIS) and additional public hearings. Subject to court oversight, limited property acquisition and right-of-way clearance were permitted in cases of hardship or in the interest of public safety. At this writing, the draft EIS process has been completed and the Final EIS is now being circulated. CalTrans predicts that a decision on the project could be reached someting in the spring of 1977.*

B. School

The present Los Angeles Southwest College site was used as a sanitary landfill up until the time it was acquired by the LA Unified District in 1953. It was the Watts riots of 1964 and subsequent discussions with Watts community leaders that led to the acquisition of the site by the Los Angeles Community College District in 1965.

The college opened in 1967, using temporary facilities consisting of barracks and other portable-type buildings. Design of permanent facilities began in 1966, when the College District contracted with a Los Angeles Architectural firm. Construction on the first of 5 phases of the permanent facilities began in 1974. At present, all college activities are conducted in the temporary structures. None of the permanent facilities are complete.

Los Angeles Southwest College is a two year community college. It is situated in a relatively low-income area of greater Los Angeles. Current enrollment is estimated around 6,000, including both daytime and night-time students. Approximately 95 percent or more of the student body is black; and, in fact, the college service area is predominantly black.

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* For a more complete discussion, see the report prepared by CalTrans, Status of the Route 105 Project, February 1976, Appendix 2.

The college is primarily a commuter school. Classes are conducted day and night, since many of the students work full time. Unlike other community colleges in the Los Angeles area, Southwest does not have inter-collegiate athletics. It is a feeling among some college personnel that many students who would otherwise attend Southwest seek other colleges for their athletic programs. Though Southwest has a field house and athletic field, the facilities are run down and unusable, largely as a result of a seemingly incurable problem with gophers and gopher holes.

C. Proximity Relationships

The Southwest College site is located in a lower income predominantly black area of Los Angeles County. The site is effectively land locked with no room for expansion beyond what is presently planned in the five phase master plan. The northern boundary stretches approximately 2,000 feet along the Imperial Highway. I-105 will provide an alternate to this major Los Angeles area arterial street. Along the western site boundary, another major arterial, Western Avenue, traverses approximately 1,500 feet of college property. The eastern college boundary abuts a large Catholic church and a portion of property which the college expects to receive from CalTrans in compensation for the additional property taken in the interchange design change. This additional parcel will provide access on the eastern side to Montrose Avenue. The entire southern boundary of the college is defined by the proposed route for I-105.

Plans for I-105 call for a major interchange at Western Avenue, on the southwestern corner of the college's property. The freeway and its relation to the college site are shown in the situational diagram on page 3. Currently, the proposed route 105 location is a wide, deep, and rugged ravine. Although there is a railroad right-of-way and an electric power transmission line in the ravine, the area is semi-wild in nature. When built, the freeway will be closest to the college's proposed athletic facilities.

II. IMPACTS

A. On School

Since neither the freeway nor the school has been built, it is the interaction of school and highway planning processes that is of principal interest in this case study. With both school and highway in the design stages, the climate has been right for maximum school and highway communication and cooperation. It is interesting that most communication between the two groups has been on an ad hoc rather than any kind of formal or structured basis. There were, of course, the public hearings conducted by the Division of Highways and the contacts necessitated by property acquisition needs.

As freeway and school planning has progressed, there has been a tendency on the part of the principal school actors to locate a contact person in the CalTrans Los Angeles office who, through periodic requests or conversations, can provide current information on the freeway status.

It is the unanimous opinion of the school planners and personnel that communication with CalTrans, though poor in the beginning, is now quite good. The sequence of school and highway planning events will illustrate this transformation. In January 1966, the architect first began the design of permanent facilities for Southwest College. According to the information of school planners, a significant freeway design change occurred in October of 1969. In keeping with advancing expertise in freeway design and in knowledge of potential traffic problems, CalTrans modified the I-105/Western Avenue interchange from a diamond-shaped off-ramp to a partial cloverleaf type. This new configuration will require the taking of additional school property for freeway construction. Again, according to school planners, their own first knowledge of this change came in December 1969. By this time the architect had substantially completed the College Master Plan. The freeway design change has required a complete revision of the former master plan. Further design changes were necessitated when legislation, issued subsequent to the Sylmar earthquake of 1971, required that school facilities be earthquake proofed.

Somewhat fortuitously, a large parcel of property on the college's eastern side became available to CalTrans. CalTrans has publicly agreed to cooperate with the College district to compensate for the plan revision and property loss resulting from the design change. The exact amount of compensation is yet to be determined and will, no doubt, be the subject of lengthy negotiations between the College District and CalTrans. However, it appears certain that the new parcel will be a part of that compensation (the final College Master Plan incorporates this acquisition) as will some level of monetary settlement for the freeway-generated college design change.

The impacts to the school as a result of the highway will be mixed. On the positive side, the freeway will aid the commuting student. The freeway design change will require the complete relocation of athletic facilities. This relocation is largely positive since the old facilities are in poor condition and unusable from the large and uncontrollable gopher population.

There is some possibility the freeway, by its development of the semi-wild ravine and the resultant relocation of athletic fields, will solve the gopher problem. Since CalTrans has been very cooperative, and since the freeway has helped free the eastern parcel, the college has obtained much needed access to Montrose Avenue.

On the negative side, delays in the college construction caused in major part by the freeway, have increased not only the cost of planning and design but also the final construction costs. The actual project costs have been caught in the recent inflationary spiral, outstripping the College District's ability to finance the college. For construction that was initially estimated at $12 million, the most recent estimate is $17 million. To compensate, the College District cut back in design to save an estimated $1 million.

The delay in freeway construction has had some negative impact on construction of the college's new athletic facilities. These new facilities are phase 5 of 5 phases in the new construction because they are to be located adjacent to the new freeway. Viewed from the perspective of the college officials and the community, the athletic facilities are quite important, first as an attraction to prospective students and second, as an additional recreational resource for the surrounding community.

In terms of other impacts, there may be noticeable increases in pollutants as a result of the freeway construction, and there may be increased traffic volumes on Western Avenue. But, generally, traffic conditions are expected to improve through reduction of the traffic load on the Imperial Highway and through safer access and exit designs incorporated in the freeway. The new college buildings themselves will be located in the center of the parcel, buffered from streets and the freeway by landscaping, parking, and, on the south side, the athletic facilities. These buffers with the planned central heating and air conditioning are expected to eliminate most potential traffic noise problems.

B. On Highway

The college has had minimal impact on the highway or, more accurately, the highway planning process. CalTrans has become more aware of the wide-reaching effects of freeways, partly through the benefit of more experience gained over the years of freeway design, partly through the requirements imposed by the court case, and partly through environmental review requirements. The college case has to some degree helped to reinforce these trends. The college's primary impact, if it can be called an impact since it is freeway generated, is the compensation CalTran's must undoubtedly provide to the College District for taking additional property and for changes to college master plans.

III. MITIGATION

The College District has revised its master plan to accommodate the changes in freeway design. Phase 1 of the college's construction of permanent facilities is nearing completion. The new master plan reflects both noise considerations and new traffic patterns resulting from the freeway. Classrooms and offices will be clustered in the center of the site with noise buffers provided by landscaping and parking facilities. On the southern portion, the athletic fields will be adjacent to the freeway to provide a noise buffer.

CalTrans will compensate the District through reimbursement for master plan changes and through property trades. The exact settlement has not yet been determined.

IV. SUMMARY AND RECOMMENDATIONS

A. Lessons Learned

Though there were concerns about early College and Highway communication, most parties interviewed now think that the communication and cooperation is as good as it could be. This evolution has been gradual and mostly ad hoc. Awareness of environmental and public participation needs in the recent decade has also contributed. As the highway planners are proud to point out, this was one of the first freeway projects to use a multidisciplinary approach. However, this interdisciplinary approach was provided through a team of consultants hired after the route had been selected. As the lead consultant observed,* "There are two approaches to accommodating a freeway to the existing urban environment. One is to adapt the freeway to the community; the other to adapt the community to the freeway." While a number of factors were considered prior to route location, much of the remaining work, including the interdisciplinary approach and environmental review, has occurred after initial route location. There may be some freeway realignment as a result, but the freeway, if built, will probably keep largely to the originally adopted route.

The obvious, and all to simplistic, observation is that environmental and socio-economic considerations, the multidisciplinary approach, should have had more emphasis earlier in the planning process. It is all too simplistic an observation because route studies for the I-105 freeway did include some consideration of socio-economic factors. Still, at least in the initial stages, the College District was in the position of having to "adapt the community to the freeway," for the Western Avenue interchange design modification was the unilateral decision of the highway planners. It is due to the cooperative spirit of CalTrans and, in large measure, good luck that impacts to the school have been mitigated.

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*Based upon a report prepared for the California Division of Highways, Inter-state 105 Freeway, Gruen and Associates, December, 1970.

B. Suggestions

Earlier coordination between the College District and CalTrans could have reduced some of the costs of planning. The multidisciplinary approach should have been employed during route evaluation as well as after.

Some kind of formal communications structure with those directly involved in the freeway location could aid the early communication process. While the present ad hoc structure may work, it seems to have resulted after problems occurred rather than before.

These observations suggest that a state's formal freeway planning process itself is a point for meaninfgul efforts in reducing freeway related impacts.

CHRONOLOGY - LOS ANGELES SOUTHWEST COLLEGE

1953	Los Angeles Unified School District acquired the property, which up until this time had been used as a landfill.
1958	The California State Division of Highways began route location studies.
1959	State Legislature formally included route I-105 in the California Freeway and Expressway System.
1963	The Division of Highways held the first public hearing on the I-105 project.
1964	Watts District riots broke out. Watts, approximately 3 miles east of the site, is within the service area of Los Angeles Southwest College.
August, 1965	The Highway Commission held the second public hearing on the I-105 project.
November, 1965	The Commission adopted the west half of the route, or that portion from Los Angeles International Airport to Central Avenue in Watts.
1966	Born out of discussions held subsequent to the Watts riots, the Los Angeles Community College District acquired the present site for construction of Los Angeles Southwest College. During this same year, barracks and portable buildings were moved on-site to provide interim facilities. An architect was selected and design of permanent facilities began.
1967	The college opened, using interim facilities.
1968	I-105 added to the Federal Interstate System.
May , 1969	The Highway District (now CalTrans) established a field office at the center of the route on Central Avenue in the Watts District.
October, 1969	Interchange design of the freeway and Western Avenue, affecting the southwest corner of the college site, was changed from a diamong type to a partial cloverleaf type. This loss of a portion of the athletic fields necessitated a complete design change, by the architect, of the proposed permanent facilities and site plans.

June, 1970	Architect began revision of site and facilities plan. The original plan had shown a guadrangle-type cluster of buildings, but was changed to a multi-story facility running parallel lengthwise to Imperial Highway. Re-siting of the athletic fields was also required.
February, 1971	CalTrans personnel met with the Community College District Board and informally agreed to cooperate. This cooperation is expected to include a property exchange for the additional land taken by CalTrans, and reimbursement, in a yet to be determined sume, for changes to college design plans.
July, 1972	Preliminary injunction obtained pursuant to a class action suit filed by the Center for Law in the Public Interest. Plaintiffs included the Sierra Club, the NAACP, and the City of Hawthorne among others (See Status of the Route 105 Project, prepared in February 1976 by CalTrans). The injunction required, among other things, a formal EIS as well as additional corridor and design public hearings.
1974	The first of five phases of new college construction began with work on the mail classroom/administration building. Final phases will include construction of the athletic fields.
December, 1974	Draft EIS released for public review and comment.
Present	Work continues on the first phases of college permanent facilities construction. A final decision on freeway construction still awaits evaluation of the Final EIS. A final decision is expected sometime in 1977.

PERSONS CONTACTED: LOS ANGELES SOUTHWEST COLLEGE

Mr. George Ealer
Facilities
Los Angeles Community College District
2140 W. Olympic Boulevard
Los Angeles, Ca.90006

Among other responsibilities, manages the community college planning function.

Brief personal interview. New to the job and referred us to Mr. Shannon, below.

Mr. Tex Shannon
Facilities Planner
Los Angeles Community College District
2140 W. Olympic Blvd.
Los Angeles, Ca. 90006

Community College District planner in change of the Southwest project.

Interviewed in person.

Mr. P. Reibsamen
Architect
Honnold, Reibsamen and Rex, Architects
9026 Melrose
W. Hollywood, California 90069

Architect in charge of the design of new Southwest College facilities.

Dr. Luther Guynes
Assistant to the President
Los Angeles Southwest College
11514 Western Avenue
Los Angeles, Ca. 90047

Has been directly involved in the ongoing operations and planning process.

Interviewed in person.

Mr. Don Cross
Project Engineer, CalTrans
120 South Spring Street
Los Angeles, Ca. 90012

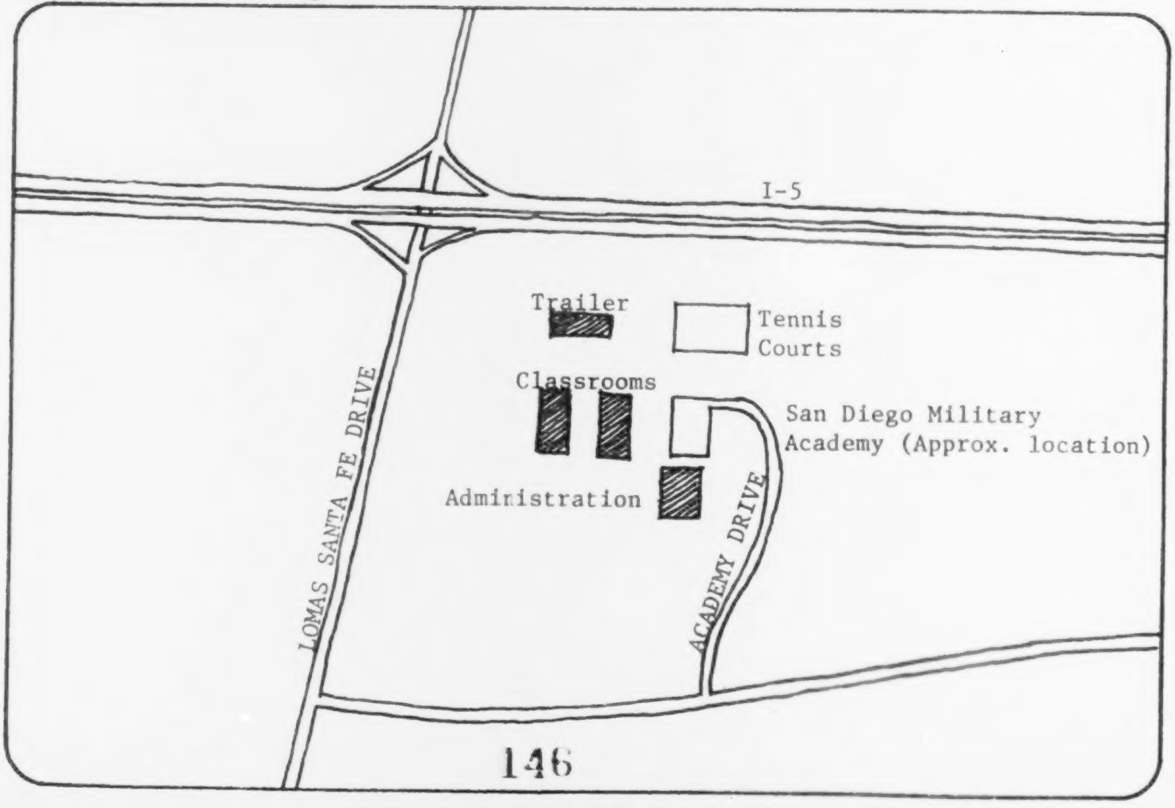
Responsible for planning the portion of I-105 in the Southwest College area.

Interviewed in person.

case study background data

school	highway
San Diego Military Academy Solana Beach, California Private School	I-5
Private military academy for secondary level students Present enrollment: 200 students	I-5 - Major north-south interstate system with 8 lanes and an interchange in the area of the military adademy

situational diagram



I. SITUATIONAL CONTEXT - HISTORY AND CURRENT STATUS

A. Highway

Interstate 5 is a major north-south link in the national interstate system. In the Solana Beach area, where the San Diego Military Academy is located, I-5 is 8 lanes wide. Work on the freeway began in 1961.

B. School

San Diego Military Academy is a private secondary level academy that was formed in 1958 on the present site. In 1965, the school had approximately 160 students; it now has 200 students. The Academy is approximately 20 miles north of San Diego. Prior to the construction of I-5, access to the Academy was via U.S. Highway 101, approximately one mile distant over Lomas-Santa Fe Drive.

The school has a national service area, though much of its attendance results from its close proximity to San Diego, which has large Marine and Navy bases nearby. Camp Pendleton Marine Base is some 15 miles north on I-5.

C. Proximity Relationships

The Academy is located on a plateau-like hill some 50 to 60 feet above I-5, and the Lomas-Santa Fe Drive interchange. Academy property borders both the interstate and Lomas-Santa Fe Drive, being located at the southwest corner of the interchange. The closest building is approximately 200 feet distant from the southbound lane of the freeway. The classroom buildings and dormitories are located away from the freeway on the southwest portion of the plateau. Tennis courts and a caretakers trailer are the Academy facilities located closest to the freeway.

Lomas-Santa Fe Drive is located over 100 yards from the nearest Academy facility. Lomas-Santa Fe Drive runs downhill west of the freeway so it is still further below the Academy's hill.

Access to the Academy is via a private drive from Stevens Road, a cross-street with Lomas-Santa Fe Drive.

II. IMPACTS

A. On School

Impacts on the school have been extremely positive. The freeway has increased accessibility to the Academy from both Los Angeles and San Diego. In addition, the school is sited on a hill overlooking the freeway. This siting has given the school increased visibility to passing traffic. North-bound traffic may see the school while still some distance south. Upon approach, a small sign pronounces that the site is "San Diego Military Academy." This visibility has effectively served to advertise the school to passing motorists. The well maintained and pleasantly landscaped Academy facilities also serve to enhance the added visibility.

Though there is some freeway noise, there have been no complaints, and Academy personnel and students state they scarcely notice. The hillside location of the Academy effectively attenuates the freeway noise.

B. On Highway

There have been no significant impacts to the highway. The Lomas-Santa Fe interchange did require the taking of a small portion of Academy property. This created no problem, since the land was at the bottom of the hill and was not planned for any future use. Three small buildings and 3 acres were taken. Compensation satisfactory to both school and highway was established. In fact, the school profited from the loss of its buildings - the small buildings were purchased at auction and relocated on the Academy site, a transaction which resulted in some savings.

III. MITIGATION

No mitigation measures have been proposed since there have been no negative impacts. The school director did mention that more freeway landscaping would be beneficial, but this was more from an aesthetic viewpoint and not from any sense of corrective action needed by the freeway.

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IV. SUMMARY AND RECOMMENDATIONS

A. Lessions Learned

This case points to the positive impacts that freeways can have. The careful siting of the freeway and the desireable location of the Academy have been positive.

B. Suggestions

The Academy did not learn of the freeway until notified of the taking of three acres. The results in this case were positive. Still, some preliminary notification with a chance for comment from the parties affected could have been included in the freeway planning process.

case study background data

school

Soto Street
1020 South Soto Street
Los Angeles, California
Los Angeles City Unified School District

K-6, 400 students
1937
Two story, reinforced concrete, classrooms to either side of central corridor.

highway

I-5, I-10, U.S. 101, CA. 60

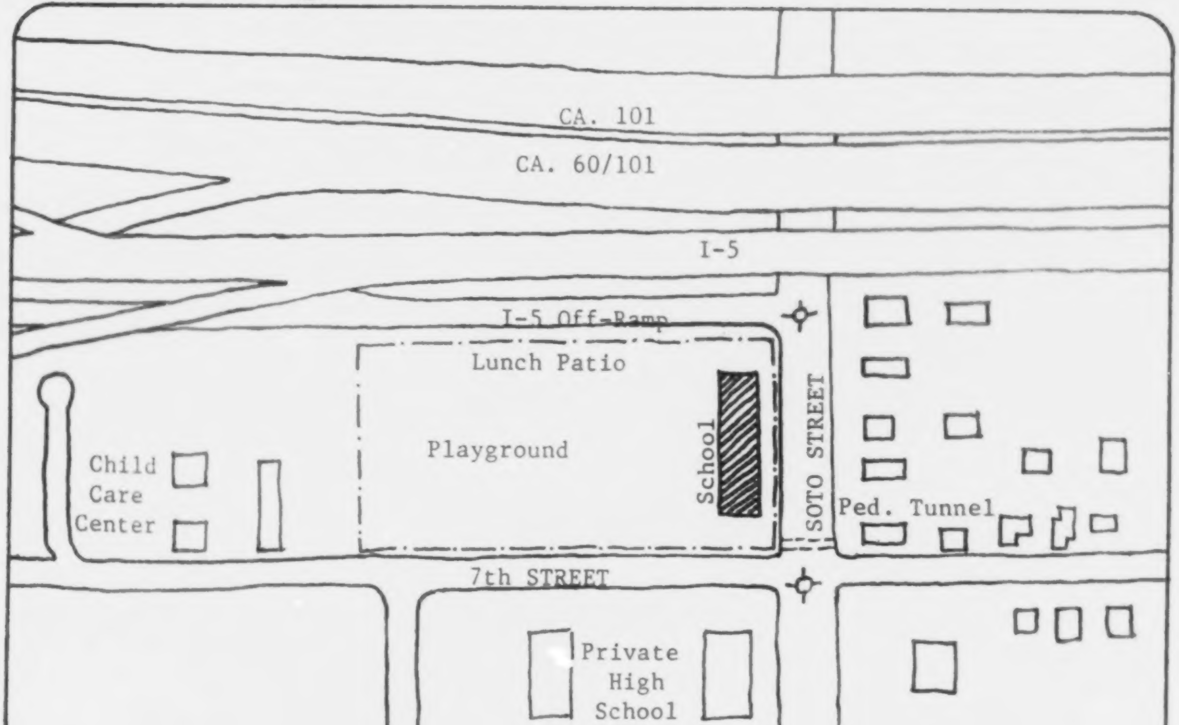
School directly adjacent to two lane off-ramp and three-lane freeway on structure. Part of complex multi-freeway connection with approximately 24 lanes.

Soto Street six-lane major street with high proportion of commercial traffic.

ADT: California 60--140,000 (1975)

Speeds: 50 mph, heavy rush hour congestion.

situational diagram



I. SITUATIONAL CONTEXT

A. Highway

As indicated in the accompanying sketch, the school is directly adjacent to two major routes, Soto Street to the west and Interstate Route 5 (I-5), the Santa Anna Freeway, to the south. I-5 in the vicinity of the school is actually only a part of one of the major freeway junctions in the Los Angeles Basin. The school is set back approximately 30 feet from the edge of the curb of Soto Street, which is at grade with the school. Soto Street climbs fairly steeply to the top of a hill at its intersection with 7th Street. A high proportion of the traffic on the street has always been commercial because of the direct access to the major industrial area about one mile south of the school. Much of this traffic is now generated by the on- and off-ramps of the three freeways which meet in the area between the school and the industrial zone. Soto Street has six traffic lanes for the length of the block adjacent to the school. This becomes four lanes plus two for parking in the block to the north. The street is maintained by the City and County of Los Angeles.

A two lane off-ramp from I-5 forms the southern boundary of the school site. This descends from structure to run at grade along the side of the site. The four westbound lanes of I-5 on structure at an elevation approximately level with the second floor of the school are parallel to the off-ramp and approximately 100 feet from the south end of the school building. Further to the south are the many ramps and connectors which are necessary to link Interstate 5 and 10 (Santa Monica Freeway), California 60 (Pomona Freeway) and U.S. 101 (Hollywood Freeway). The terrain in the area is hilly and most of these roadways are on structure. The peak hour traffic counts at this junction are among the highest in the Los Angeles area. Contracts were awarded for most of this construction in 1954.

B. School

Soto Street is a 400 student public elementary school, grades K-6, operated by the Los Angeles Unified School District. The building was constructed in 1937 to replace one built on the site in 1911 and destroyed by an earthquake in 1933. There are sixteen classrooms on two floors arranged on either side of central corridors. As built in the 1930s, the building had an additional wing with a cafeteria and auditorium placed south of the classroom building. This was demolished due to the land clearance necessary for the freeways. At that time a substantial area of playground was taken for right-of-way and the remainder was made level with large quantities of fill from the freeway construction. Because of the shrinking of the playground, a children's center, which had been located on 7th Street next to the school building, was moved approximately 500 feet down the hill to the east. This created more space on the playground, but has hampered the necessary functional relationships between the two programs. Classrooms in the school building have hard surface floors, high ceilings, and exterior walls which are almost entirely glass. Weather permitting, students eat outside on a patio located on the south end of the school building next to the off-ramp.

All students live in the surrounding neighborhoods and are primarily Mexican-American. Most walk to school, a few are driven by their parents. The school appears to serve as an important community facility, but it is not used for major gatherings due to the lack of an auditorium. There is a lunch patio which is used, weather permitting, in conjunction with the steps at the south end of the building, as an outdoor amphitheater. This is the side most severely impacted by noise.

C. Proximity Relationships

The neighborhoods surrounding the school are hilly. The areas to the south and west are primarily industrial, with pockets of rental housing which generates some Soto Street students. North and east are a mix of residential and commercial neighborhoods which generate the majority of students. Students living in the industrial area have to walk across a long viaduct spanning several freeways and a mainline railroad and then most cross several freeways on- and off-ramp intersections with Soto Street. There is a traffic light at the intersection of the I-5 off-ramp and Soto Street at the southwest corner of the school, and one at the intersection of Soto and 7th Streets. The latter was installed in 1975 to augment a pedestrian tunnel crossing Soto Street near that corner. The tunnel had become a definite health and safety hazard, and the school has a standing request with the city that it be closed off. There are no school crossing warning signs on Soto Street, and there is no location which is reserved for parents who drive to drop off or pick up their children. No students come by bus. If buses were used, the only safe and convenient place for loading is on the school playground. A crossing guard is on duty for seven hours during the day, although the city does not usually supply one where there are traffic lights.

II. IMPACTS

A. On School

The major impact of the adjacent highways on the school is noise. Even without the freeways, peak noise in the classrooms facing Soto Street would still be close to 80 decibels. This is due to the acceleration of trucks from stoplights at the southwest and northwest corners of the site and also to the need to climb the Soto Street grade northbound. Peak noise and air pollution are worst in the classrooms which face Soto Street on the second floor. This is because many trucks have elevated exhaust stacks which direct both impacts upwards. Freeway noise peaks are slightly lower in classrooms on both sides of the building due to the somewhat greater distances to the freeways. These peaks primarily result from the deceleration of trucks on the off-ramp adjacent to the school and those descending a slight grade on I-5 westbound. Impact from these sources is, again, greater in the second floor classrooms because the sources are raised. Noise has been measured by CalTrans in order to determine the qualification for the school noise abatement program (see Appendix for further description). The major subjective indicator is continual disruption and distraction caused by noise interference. Teachers report that visual distraction accompanies the noise impacts and students often turn to watch as trucks pass the school. The principal reports that students tend to be quieter on the playground than they might otherwise be because of the high ambient noise level.

Air pollution appears to be a major problem, particularly in the second floor classrooms facing Soto Street. Staff report tiredness, headaches and hoarseness which they feel are associated with this problem. Several have requested transfers from the school because of the impacts of this pollution on their health. No site-specific measurements have been made so that it is difficult to separate local pollution impacts from the fact that the entire central Los Angeles area in which the school is located experiences very high pollution levels. The principal reports that nearby schools, some on Soto Street, which are further removed from the freeways do not experience anywhere near the magnitude of this problem in their classrooms.

The other major impact relates to pedestrian safety and convenience for many of the students walking to school. Some of these problems are related to the fact that the boundaries of the school's attendance area do not coincide with network of freeways to the south. As mentioned above, the students walking from the neighborhoods to the south must cross many freeway on- and off-ramps, and for some, a long viaduct. Although there are no reported accidents, the fear of danger causes some of the parents of these students to either drive them to school or, in some instances, to move to other neighborhoods where the walk to school is safer. As mentioned earlier, the pedestrian tunnel under Soto Street has been fraught with health and personal safety hazards for students and after several years of requests was finally replaced by a traffic light at the corner of 7th and Soto Streets.

As no children are bused to the school, the absence of a pick-up and drop-off lane on Soto Street causes less inconvenience than it might. Parents with cars must wait some distance from the school building on

7th Street, or they sometimes use the playground. There is no place where children may wait with supervision and under cover in bad weather which also gives a view of arriving parents.

The school also experiences continual problems with rats which come out of the landscaped area between the off-ramp and the southern boundary of the school site and onto the playground.

B. On Highways

There have been incidents, one of them serious, in which students walking on bridges or viaducts over freeways have thrown objects onto cars and the roadway below. As a result, high fencing has been installed by CalTrans in some of these locations.

Another impact of the school on the highway has been some obstruction of the traffic flow on Soto Street caused by the installation of the traffic light at 7th Street. This causes a slowing of traffic but no reported congestion.

The school has restricted students from playing ball games on the playground along the southern edge of the site because the balls used to go over the fence and the adjacent narrow landscape strip and onto the off-ramp.

III. MITIGATION

A. Measures Proposed

Certain realistically feasible measures for mitigating negative impacts proposed within the past five years have been implemented: installation of a traffic light, safety fencing on overpasses, left turn bays from Soto onto 7th Street. The most important measure, sealing off the building against noise and air pollution and installing air conditioning, has yet to be carried out, although this has been the subject of the greatest amount of controversy and planning effort.

Although the school has been subject to noise and pollution impacts from both Soto Street and the adjacent freeway for many years, it was not until 1972, that a mandate to abate these impacts came in the form of the California Legislature's passage of the school freeway noise abatement program. Measurements taken by CalTrans to determine the School's eligibility showed that noise levels due to the freeway were well above the 50dBa peak allowed, but they also revealed that the peak noise levels along the Soto Street side of the building due to sources other than the freeway, in this case traffic on Soto Street itself, were higher than those due to the freeway. Therefore, under the program guidelines requiring that freeway noise levels need only be attenuated down to the levels of noise from other local sources when these are over 50dBa, CalTrans could not take any measures to alleviate noise in any of the classrooms facing Soto Street, those which are in fact worst impacted. This limitation was put in the enabling legislation with the clear intent of insulating the program from having to deal with conditions for which the state highway system was not responsible, and yet the irony of the outcome of this restriction as applied to the situation at Soto Street was impossible for school staff and parents to accept.

The principal organized staff and parents to lobby with their local state assemblyman, who happened to be on the Committee on Transportation, the local city councilman, and the School District, to secure whatever special legislation would be necessary to allow both halves of the building to be air-conditioned. CalTrans had already determined that construction of a noise wall along the freeway was infeasible, and this was the reason for the initial decision to resort to air conditioning for whatever noise abatement would be provided.

The focus was turned on special legislation only after the school staff and parents conducted an investigation and found that neither the School District nor CalTrans was able to satisfy the request for additional air conditioning. The school arranged a meeting between the School District and CalTrans' noise program staff, the parents and the local state assemblyman to clarify the situation and explore alternatives. The result of the meeting was for the assemblyman to first propose an amendment to the Streets and Highways Code sections describing the scope of the school noise abatement program, expanding it to include noise from highway as well as freeway traffic, and to impose similar requirements on the boards of supervisors with respect to county highways and on legislative bodies of cities with respect to city streets.

These requirements were opposed by all those affected as too broad in scope and therefor costly. The proposed amendments were then redrafted in the form of a special law pertaining to the Soto Street School only. This amendment recited that the prime reason for the traffic noise on Soto Street was traffic entering the nearby state freeways and declared that CalTrans undertake noise abatement procedures "notwithstanding the fact that the traffic-noise level in the front portion of the school is produced by traffic on a city street."

The School District allowed the principal to testify on behalf of the bill and was the source of information concerning lobbying techniques. CalTrans testified against the bill on the basis that it would set a precedent which would further strain already shrinking highway funds. The bill passed the legislature and was allowed to become law by the governor under the California system of pocket passage rather than pocket veto.

CalTrans estimates that using a rough estimated cost of $10,000 per classroom for these improvements, the cost of noise abatement work at the school will increase from $90,000 for nine classrooms to $160,000 for sixteen classrooms. Another of the results of the meeting was that the School District advanced Soto Street to the top of the noise abatement priority list proposed to CalTrans. The work will therefore be carried out as soon as the noise program receives substantial funding, now projected for the 1977-1978 fiscal year.

IV. SUMMARY AND RECOMMENDATIONS

Soto Street School is an example of the continuing problems resulting from the expediencies of past highway route location planning which took little or no notice of neighborhood impacts, particularly in lower income and minority neighborhoods. At the time the adjacent freeways were built, the school should probably have been relocated. This is another way of saying that the lessons learned about the impacts at the Soto Street situation, on both the school and the highways, will hopefully not need to be applied to the planning of future facilities of either type.

Among these lessons are the following:

- The acceleration of trucks, either up a grade or away from a stop sign or stop light, causes noise peaks that are extremely distracting to the teaching/learning process. Unless these peaks are very infrequent, they impose a strain on students and teachers. Therefore, a very low volume of truck traffic is the threshold of annoyance and distraction, beyond that, increases in volume only worsen an already unacceptable situation.

- Any impediment to a continuous flow of traffic causes major increases in traffic noise, particularly those generated by trucks. Grades, stop signs, stop lights and congestion are the typical impediments which have this effect.

- Classrooms in the second story of a school adjacent to a highway will tend to experience greater noise and air pollution impacts because of the outlet heights of truck exhaust stacks.

- Any overpasses, either pedestrian or highway, used by students walking to school should be protected from thrown objects by fencing.

- Overcrossings are preferable to pedestrian crossing tunnels which tend to be a safety hazard.

- It appears that the parents, principal and staff of a school are the most motivated and appropriate group to look after the interests of their particular school. This idea usually does not appear obvious to this group when they first became concerned with having changes made in conditions at their school. Often the agencies which school users are led to perceive as having the capability of making improvements-- the school district, city government, and the state highway department-- face severe strains from the competing demands for funds and staff time of their many constituents. They are, therefore, very wary of offering special attention to any one group, or school, unless forced to do so by severe political pressure or, as in this case, by special legislation. Those groups which become effective in dealing with government agencies do so as a result of lobbying state legislatures rather than limiting their demands as the agencies from which they request service.

Suggestions

The recommendations given by the respondents came in the form of pleas. The school principal called for more responsiveness from the school and board of the School District to the special needs of the school. There was a wish that the School District take more of an advocacy role in pressing other agencies such as CalTrans and the city government to take responsibility for responding to the school's need for impact abatement. This is something that a district with several hundred schools is reluctant to do. The School District did provide technical assistance to school staff and parents for the purposes of lobbying the legislature, and this may be a reasonable limit to the effort it should expend on the problems of the individual schools where there is concern and leadership among school staff and parents. Parents in particular are more free to make special demands of agencies and the legislature. The institutions such as School Districts and state and local highway departments, which are charged with improving highway and school facilities, now operate with severe budget restraints and are, therefore, unwilling to take on new projects to compete for funds with existing projects. It is natural that they will only do so under a legislative mandate. This may be the most appropriate method for dealing with exceptional problem situations such as the one at Soto Street.

For their part, the agencies named above are worried about the precedent established by the Soto Street situation because no additional funding accomplanies the demands made upon them for more improvements, at least not in the short term. There are many proposed projects with higher priority than school/highway impact abatement. The lesson of this case, thought not one articulated by any of the respondents, is that it is far less expensive in terms of time, effort and funding to plan the relative locations of freeways and schools very carefully from the outset in order to avoid costly mistakes and use conflicts such as the one at Soto Street.

CHRONOLOGY -- SOTO STREET SCHOOL

1911	Original school constructed.
1937	Present school constructed to replace the original damaged in 1933 earthquake.
1954	Freeway construction contracts let, playgrounds redesigned and auditorium and gymnasium demolished due to land taken for right-of-way.
1974	Traffic light installed on Soto Street.
1975	CalTrans makes preliminary measurements of noise impacts, informs school that noise from Soto Street itself could not be mitigated under regulations of the existing state highway/school noise abatement program.
1976	Intensive lobbying of State Legislature and School District by school parents and staff for funding to mitigate Soto Street noise impacts. Results in passage of 'special law' for Soto Street School effective January 1977.

PERSONS CONTACTED: SOTO STREET SCHOOL

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Dr. Jerry Lucas
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California Department of Health
Berkeley, California
(By Telephone)

Mr. Harry Saunders
Los Angeles Unified School District
School Building and Planning Department
425 South San Pedro
Los Angeles, California 90051

Mr. Frank J. Weidler
Project Development Branch D
CalTrans
120 South Spring Street
Los Angeles, California 90012

school

Rinaldi Street
17450 Rinaldi Street
Granada Hills (Los Angeles) California
Los Angeles City Unified School District

K-6, 550 students

1950

Single story wood frame and stucco

5 portable classrooms

School to be relocated before freeway construction

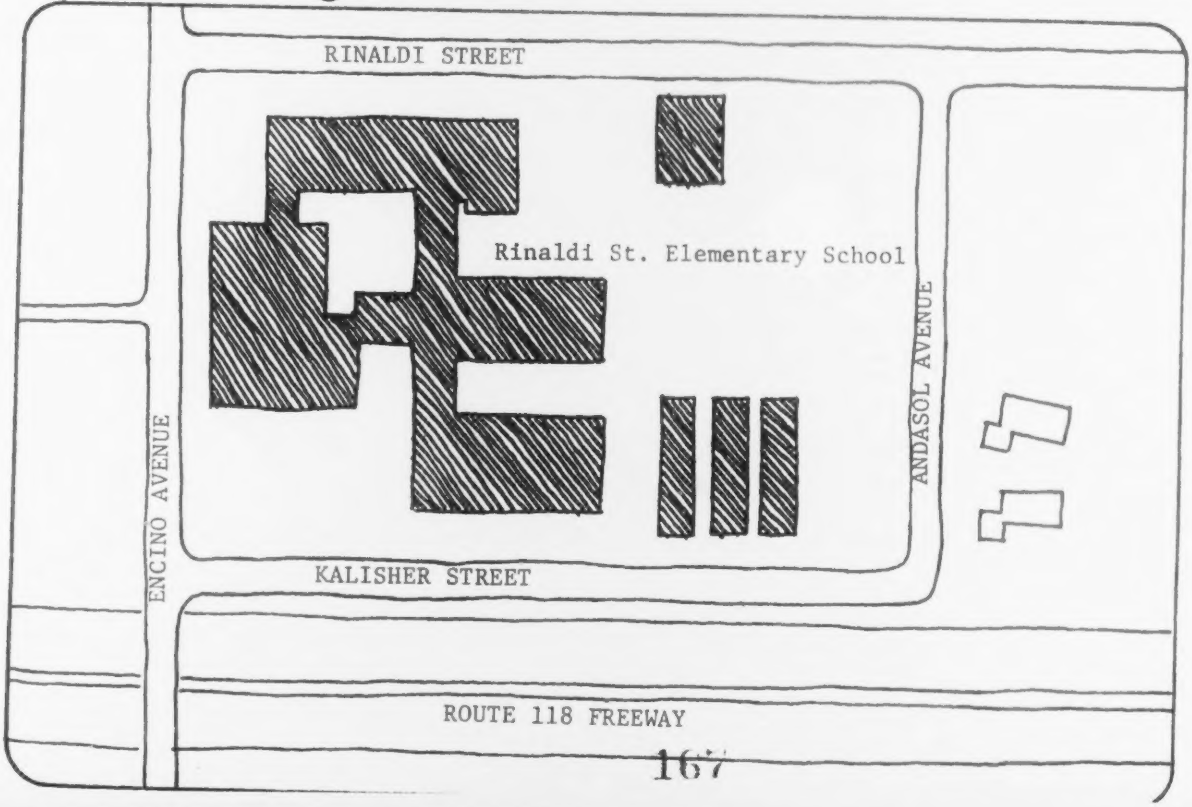
highway

California 118

Proposed 8 lane freeway, depressed 32 feet below surrounding grade

ADT: 68,000 (1980 construction year)
155,000 (2000 design year)

situational diagram



I. SITUATIONAL CONTEXT--HISTORY AND CURRENT STATUS

A. Highway

The existing Rinaldi Street School is immediately adjacent to the right-of-way of the planned Simi Valley-San Fernando Valley Freeway (State Rouge 118) in Los Angeles County, California. Detailed design of the highway has been completed and construction of the 5.1 mile section, which is the subject of this case, awaits funding, now projected for 1978-1979. The roadway will have four lanes in each direction and will be 170 feet wide, the estimated average daily traffic is 63,000 in 1968 (construction year) and 155,000 in 2000 (design year).

Corridor studies began in 1959 through an area which at the time was still rapidly expanding suburb on the edge of the Los Angeles Metropolitan Area. Four routes were studied and the route chosen just fits between the existing school site and a high tension powerline right-of-way which runs parallel to the freeway in the vicinity of the school. The possibility of locating the roadway under the power lines was studied, but proved infeasible.

At the time the route location studies were made, the Division of Highways, now called CalTrans (State Department of Transportation) had the express policy of avoiding the taking of any "public institutions" such as churches, schools or other community facilities. This policy was based on the theory that the cost to the community was higher is this type of building were taken rather than individual homes. As there was sufficient room between the school site and the existing powerline right-of-way, that route choice was favored. As originally proposed, the roadway profile was at or near grade and balanced cut and fill requirements along the route.

The present Route 118 is Devonshire Street, 1-1/3 miles to the south. Rinaldi Street, a four lane, one mile grid street, forms the north edge of the school site. Traffic is generally light except at commute hours when it increases to moderate. Presently, there is almost no heavy truck traffic.

B. School

Rinaldi Street is a public elementary school with 475 students in grades K through 6. The school is part of the Los Angeles City Unified School District. The school site is 6.7 acres with a 720 foot frontage parallel to Rinaldi Street and the freeway. The building is single story wood frame and stucco, and there are several wood frame portable classrooms for a total of 22 classrooms. The main building is designed around a central court used, as is typical in this climate, as an outdoor lunchroom. The school was constructed in 1950. Most students walk to the school, a few are bussed due to longer walking distances. The school has an auditorium which is used by the community once or twice a week.

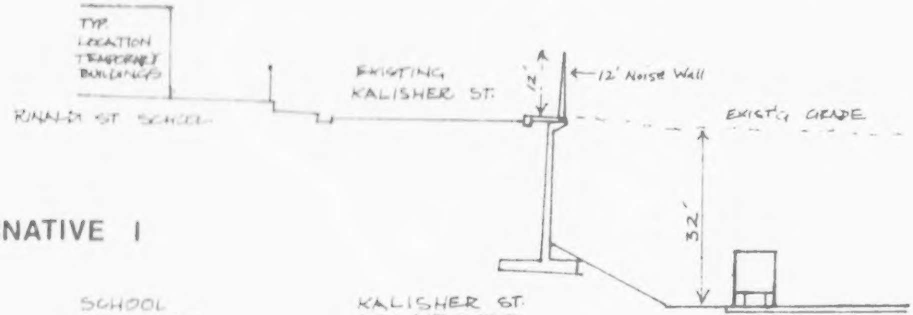
C. Proximity Relationships

Rinaldi Street itself is the approximate boundary between the gently sloping San Fernando Valley floor and the hills and canyons to the north. These hills are now being subdivided and as new homes are built, the center of gravity of the school's service area is moving north. Residential development in the immediate vicinity of the school and in the neighborhoods to the south was completed in the late 1960s. The families served by the school are middle and upper-middle income and all of the surrounding neighborhoods are developed with single family detached homes.

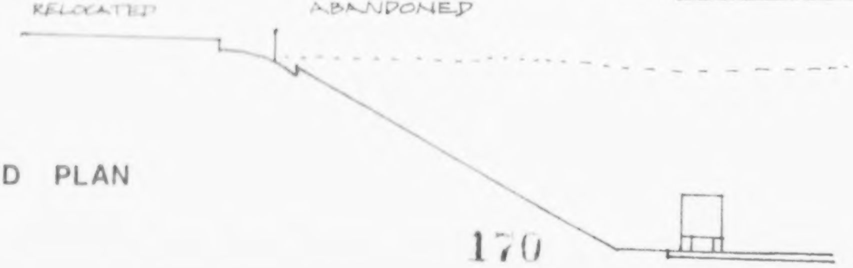
The school and Rinaldi Street are presently at grade. The freeway as originally planned would have been at grade as well, with the edge of the roadway

100 feet from the nearest part of the school building itself. The school site and the freeway were originally to be separated by an existing three lane alley called Kalisher Street, not shown on the accompanying situational sketch, because it will now be abandoned. When the freeway design was revised to depress the roadway some 30 feet below grade, the design called for the construction of a major retaining wall (see sketch "Alternative I, below) in order to maintain Kalisher Street. Depressing the roadway has the benefit, in addition to lessoning the visual and noise impact of the freeway, of allowing the secondary streets every quarter mile to cross the right-of-way at their original grade. If it had been necessary for the street crossings to go over or under the freeway at grade, they may not have been as frequent and this would have interfered with the walk to school.

The nearest freeway interchanges will be 3/5 mile to the east and 1-1/4 miles to the west. There is a stoplight on Rinaldi at the future interchange street to the east and a stop sign on Rinaldi approximately 1/2 mile to the west. There are marked crosswalks in front of the school, but no other traffic control devices. Traffic speeds on Rinaldi tend to be somewhat higher than the 30 mile per hour speed limit.



ALTERNATIVE I



PROPOSED PLAN

II. IMPACTS

The impacts which generated controversey were those of 1) freeway-related noise, both during construction and ongoing operation, 2) freeway-related air pollution, and 3) student pedestrian safety during construction. No impacts of the school on the highway were at issue, although the location of the school did result in certain changes in the freeway design in order to avoid the problem of inverse condemnation which might arise if only a part of the school site were taken.

Noise impacts were first estimated by CalTrans during detailed design as a response to state standards which went into effect in 1972 and federal standards which became effective in 1974. State standards are described only in terms of interior peak noise due to construction or highway operations. The peak noise allowed is 50 dBa, the same as for the CalTrans freeway retrofit program described in the Appendix. Projected noise contours were based upon mathematical models and empirical measurements taken at two existing freeways in the Los Angeles area, which are also depressed 30 feet below the surrounding grade. On the basis of this work, CalTrans first proposed to construct an eight-foot high noise wall on top of the freeway retaining wall (again, see sketch "Alternative I," page 42) when the initial design was presented for comments along with the Draft Environmental Impact Statement in the summer of 1974. Ambient noise before the project was measured had a peak of 50 dBa, and the first proposal predicted that classroom noise impacts would not be above that level with construction of the noise wall and without requiring any air conditioning of the building. It was proposed to build this wall as soon as possible after commencing construction and to return to the school after the highway was completed to determine whether further noise attenuation measures were needed. The adequacy of these noise impact projections and proposed mitigation measures was strongly controverted by a group of parents from the school who submitted estimates from a volunteer, independent acoustical engineer that the noise impacts would, in fact, be much greater. In response to this information, CalTrans determined that the noise wall should be 12 feet high instead of the 8 foot height initially proposed. The parents continually pressured CalTrans with the reminder that noise abatement was required by law and that there might be liability imposed on CalTrans for any subsequent auditory harm to the students. Alternative mitigation measures were proposed and revised during negotiations extending over a nine-month period. These are described in the next section.

The micro-scale air pollution impacts of the freeway upon the school were given relatively little attention until the planning process was almost completed. The projections made by CalTrans were in response to the requirements of the Environmental Impact Statement and focused mainly on effects on the Los Angeles regional air basin. The only micro-scale analysis made was a projection of the change in pollution levels along Devonshire Street, the present Route 118. These, of course, were shown to be beneficial due to the increasing amounts of traffic diverted to the new freeway. Very generalized estimates of the changes in carbon monoxide levels within 50 feet of the freeway were also presented which indicated a relatively minor impact of from zero to two parts per million (ppm) as compared to the present annual maximum daytime levels of 15-22 ppm and nighttime levels of 49 ppm. The federal standard is 35 ppm.

Again, the parents group challenged both the accuracy and the adequacy of these impact projections. The parents reacted to the absence of a discussion of lead emissions and to reports they had heard of the severe physiological reactions of a few teachers at two other schools adjacent to freeways in the Los Angeles area. The parents enlisted the support of several pediatricians who described journal articles reporting preliminary findings of inverse conditions between air pollution levels and students' athletic performance. Other experts reported that depressed freeways were the worst design from the point of view of micro-scale pollution impacts because photochemical reactions take place while the pollutants are still together inside the roadway trench and then rise in high concentrations before being diluted and dispersed. Although a noise wall may also serve to deflect the pollution, a high proportion of the lead particles are heavy enough to drop out within a short distance of their source. None of the impact predictions provided by the parent group was contested by CalTrans, but they were not willing to embark on a program of empirical measurements at comparable existing freeway/school situations as there was no legal requirement for such a program nor any mandate to take any mitigation measures. CalTrans also cited the fact that lead is being phased out of motor vehicle fuels and should be practically non-existent as a pollutant from vehicle operations within a relatively short time.

Pedestrian safety for children crossing the roadway construction was the third major impact which concerned parents and school staff. CalTrans was unwilling to commit to specific measures to assure crossing safety and this increased parents' apprehension. CalTrans suggested that it would be possible for the school to request additional crossing guards from the City of Los Angeles, but the parents were afraid that the City would plead poverty when the guards were finally shown to be necessary, and the guards might be delayed for a year while the most dangerous condition existed. It appears that this is a problem of jurisdictional coordination between the City and CalTrans for which there is no normalized channel of communication.

III. MITIGATION

During a six-month period in 1974, the parent group, which had formed in concerned response to the presentation of the proposed highway design, engaged in an intensive effort to find other opinions of projected impacts and to propose alternatives to the mitigation measures proposed by CalTrans. The following paragraphs present, in approximate chronological order, the various mitigation measures which were proposed by the concerned parties, along with a short description of the reasons for the particular proposal, where it originated from, and the responses which followed. Note that all of these measures were proposed as possible responses to the requirement to mitigate freeway noise, although some also had the objective of lessening air pollution impacts. These descriptions do not present the measures in the context of intensive negotiations in which they were first proposed. The negotiations included not only the parent group and CalTrans, but also the School District, the local U.S. Congressman, state assemblyman, city supervisor, as well as a range of interested experts who volunteered to provide information and testimony on behalf of the parent group. The results of these negotiations were often covered by local newspapers and television news programs.

A. Measures Proposed

Eight-foot high noise wall to be constructed on top of the freeway retaining wall for a distance of some 1,000 feet. This was the noise impact abatement measure originally proposed by CalTrans as a means of achieving the California-required noise level of 50 dBa peak inside the school, and, incidentally, the federal standard of $70L_{10}$ on the playground. The parent group and School District staff objected that construction of this wall alone would not help mitigate any construction noise until such time as the wall was completed. These parties suggested that air conditioning would also be required. In addition, the parent group's volunteer acoustical engineer felt that the wall was not high enough to provide the desired attenuation because of the sound which would bounce off the retaining wall on the opposite side of the freeway from the school and bridge the proposed noise wall.

Six-foot high noise wall and $30,000 for use towards the cost of air conditioning impacted classrooms. This was proposed by CalTrans as a possible means of dealing with construction noise. The 6-foot wall was needed for safety, and the $30,000 reflected the cost savings resulting from removing two feet from the required wall height. CalTrans estimated that it would in fact cost over $100,000 to air-condition the 11 classrooms which would be impacted. This proposal was withdrawn for several reasons, not the least of which was the fact that it failed to meet the state noise requirements.

Twelve-foot high noise wall. CalTrans projected that this would meet the revised noise impact calculations. The parent group and School District objected that the problem of construction noise impact remained. In addition, there were unanswered questions of whether this wall would reflect noise from Rinaldi Street back at the school, and there were concerns about the visual impact in an area with single story, detached houses.

Six-foot high wall and $62,000, the latter figure representing the CalTrans estimate of the difference in cost between a 12- and 6-foot high wall which could then be applied towards air conditioning. The objection was, again, that the amount was inadequate. In addition, the parent group had found, through its own research, that air conditioning had little effect in reducing air pollution unless fitted with more costly charcoal and electronic filtration systems. Further parent group objections were based on the fact that CalTrans cannot pay for this type of equipment as it is not necessary for noise abatement and there were no other sources of funds.

Replace school building on another site and delete freeway retaining wall. This suggestion was made by a volunteer consultant to the parent group who had experience planning for and evaluating the neighborhood impacts of freeways. The School District then made a rough estimate that a new school and land would cost approximately $2.5 million less some $270,000 recovered from the sale of the present site after some of it had been taken by CalTrans for the additional right-of-way width required for an embankment in place of the planned retaining wall. The parent group consultant estimated that some $600,000 would be saved by the elimination of the retaining wall and 12-foot noise wall. The School District objected that it was impossible to raise the more than $1.5 million which would be required under this proposal.

Move school building to another site and delete freeway retaining wall. This was also proposed by the parent group's consultant. The School District and CalTrans responded to this proposal with more detailed estimates of costs. Negotiations by this time had become quite intense due to the increasing concern of local politicians over the possible delay of the freeway project and the increased coverage of the problem by local news media. The School District estimated that moving the building to one of a few possible sites within one-half mile would cost $1.2 million, including land. Credits towards this expense would be $255,000 from the sale of the present school site and $722,000, the amount saved by CalTrans by not having to build the retaining wall, etc. This left a deficit of $245,000. The local state assemblyman offered to sponsor special legislation for an appropriation in that amount. The parent group decided that they preferred this alternative as the best solution to the problem.

Closing the school and redistributing pupils to nearby schools, some of which had excess capacity. This option was first proposed by School District staff but later withdrawn because CalTrans stated that it could make no in-lieu payments if the school were eliminated. Parents objected to this suggestion because the walk to school of many children would be substantially increased or they would require busing and, more importantly, because of fears that property values would decline if there were no local school.

Take part of school site and delete freeway retaining wall, air-condition entire building. This alternative was proposed by CalTrans and involved CalTrans taking of a 70-foot wide strip along the southern edge of the site to allow Kalisher Street to be relocated to the north and to enable the freeway retaining wall to be replaced by an embankment. The school site would be reduced from 6.7 to 5.4 acres. Money saved from the retaining wall and the payment for the land taken would be used to relocate several portable classrooms on the school site and to air-condition all of the classrooms at a cost of $246,000. CalTrans would have saved approximately $350,000 under this alternative. The School District found this an acceptable proposal, but the parent group objected because of their increased concern over air pollution impacts and the ineffectiveness of air conditioning and also on the grounds that the school site would then be too small to allow for future expansion.

B. Measures Implemented

CalTrans and the School District have entered into a cooperative agreement for the moving of the existing school buildings to a site approximately one half mile north of its present location. This will occur whenever the freeway project is funded. This alternative was selected by the parent group soon after it was proposed by their consultant as the best means of responding to both noise and air pollution impacts of the freeway without imposing any financial burden on the School District. The parents were by that time aware that there was no legal mandate for dealing with air pollution and that this was the only solution which would effectively couple the noise and air pollution abatement measures. This alternative was also seen as responsive to the trend of increased residential development in the hills near the selected site which follows the shifting the center of gravity of the attendance area northwards. The School District expressed a willingness to participate as long as it was reimbursed for all expenses. This was to be accomplished through the combination of CalTrans' contribution from retaining wall savings, the money received from sale of the present school site, and the special appropriation from the state legislature.

Although the school principal and representatives of the parent group testified in favor of special legislation before the state legislature, it did not pass because of objectives to setting a precedent to such measures. It is now intended that this deficit will be met by increases in the CalTrans and land sale revenues due to inflation. There appears to be general satisfaction among all groups concerned with this solution.

IV. SUMMARY AND RECOMMENDATIONS

A. Lessons Learned

- The significance of each public institution (schools, churches, etc.) should be individually considered before making decisions with respect to the avoidance or condemnation of the institution when planning a highway route. The staff and users of the facility should be contacted in the early stages of route location studies in order to determine whether the negative impacts in terms of noise, air pollution, reduction in the number of users due to the taking of their homes, etc., would make it preferable to take the institution and allow it to use the condemnation payment to relocate. If this had been done at the beginning of the highway planning process, the decision to move the school might have been taken at an earlier date.

- The time involved between the first public hearings for route location, subsequent hearings for highway design, and finally, hearings on a draft environmental impact statement, can amount to five to ten years. In this case it was the latter. Community concerns, and often composition, may change radically during that time. The level of interest and input from community members and school staff increases greatly as freeway construction becomes more imminent, and this may lead to dissatisfaction with plans which had earlier been agreed to without careful consideration by different representatives at some time in the past when the project appeared to have little reality.

- The environmental impact assessment process still appears to be an afterthought to the planning process rather than an integral part of it. Community group members in this case situation complained that the public agencies involved in the planning process, the School District, and the State Highway Department, appeared to assume that the burden of proof of environmental impacts affecting the school fell on the affected community itself. The community usually has little or no access to assessment and planning expertise or experience with the planning process in general. This is in spite of the trend towards an increasing general awareness of the relevance and importance of environmental concerns and the rising expectations accompanying that awareness.

- The parent group was critical of the fact that projected impacts were presented to them, and apparently determined, on the basis of abstract modeling rather than in relation to empirical measurements of similar situations in the region. Community members felt that this approach deprived them of the means of excercising their own judgment to local situations which they could take the opportunity of experiencing for themselves. They felt that experiencing the reality of comparable situations gave them a more useful basis for deciding between alternatives.

- The parent group focused the most attention on the potential noise problem because this was the only impact which the agencies were legally mandated to abate. The other major concerns of student pedestrian safety during construction and air pollution were not as thoroughly explored by the public agencies because they were not specifically required to mitigate them. Because of this lack of mandate, the parents felt it necessary to call in local political representatives and even the media in order to form a special mandate for their particular situation. This resulted in delays and required a great deal of energy and leadership from the parent group representatives.

B. Suggestions

- CalTrans feels that route selection and highway design hearings should be combined in order to expedite the planning process and allow community members to make more informed decisions about both aspects of the proposed highway. In other words, micro- and macro-scale implications would be presented together. The process implies that the highway planners would do more extensive planning before consulting the community for decisions, and this planning would, in turn, involve more consultations with the community in order to gather the information necessary to determine the range of acceptable alternatives.

  The acceptability of alternative routes would be defined in terms of construction and cost feasibility, the Highway Department would then introduce these alternatives to the affected communities without committing itself to a preferred route or design. This type of process places the public agency more in the role of a professional serving the community as a client instead of the role of advocating one solution and being viewed as a principal adversary by the citizens adversely affected.

- CalTrans has found that the best way to restructure its relationship to communities affected by freeways, in addition to the non-partison proposal of alternatives, has been to play a passive, supporting role at community meetings called and run by community groups. This strategy has been effective in diminishing the intimidation felt by individual citizens when making comments and suggestions and has therefore encouraged more effective participation.

- The parent group found it very useful to identify and contact parents and teachers at school/highway situations similar to the one being proposed for their neighborhood. They also found it possible and very helpful to enlist the aid of volunteer consultants with expertise in the fields which they had identified as being potentially impacted.

- In addition to the absence of a mandate for the abatement of air pollution impacts, the parent group and the Highway Department found that there is little available information relating to the micro-scale impacts of air pollution from highways on schools. This appears to be an area needing further research. There is also a need for a legal requirement for the implementation of mitigation measures associated with a broader range of the negative impacts resulting from the construction of new highways.

- It appears that the formal interagency review process for projected impacts and proposed mitigation measures is inadequate and usually occurs too late in the highway planning process to be of greatest use. The parent group in this case found the most effective means of not only making its concerns known to the public agencies involved, but also assuring effective negotiations leading to an acceptable conclusion was to sponsor meetings at which all agencies and concerned politicians' staff were present. Perhaps such task forces should become an integral part of the highway planning process, or at least whenever controversial situations arise.

CHRONOLOGY -- RINALDI STREET SCHOOL

1959	Inception of route location studies by the Division of Highways, now part of CalTrans.
1964	Freeway route location hearings held in January and July and the route was adopted by the California Highway Commission in September.
1966	Freeway agreement signed with City of Los Angeles.
1968	Design roadway elevation depressed in response to requests from residents along route.
1970	Public informational meeting at which CalTrans presents four alternative study plans and recommends the plan adopted.
1974	CalTrans staff presents detailed design showing proposed noise wall to the P.T.A. at the Rinaldi Street school in June. Information presented is from the Draft Environmental Impact Statement (DEIS). The parents are dissatisified with the proposed noise and air pollution abatement measures. Parents form "FACES" (Freeway Action for Children's Environment and Safety) to press for design changes and hold first meeting with CalTrans at the end of July. FACES gets T.V. news coverage for the first time in September.
1975	CalTrans and Los Angeles City Unified School District agree that CalTrans will make in-lieu payment for moving the school.

PERSONS CONTACTED: RINALDI STREET SCHOOL

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Ms. Gigi Ray
"FACES" (Parent Group)
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Mr. Harry Saunders
Los Angeles Unified School District
School Building and Planning Department
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Mr. Jack Spankling
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17450 Rinaldi Street
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case study background data

school

Hoxie Avenue
Norwalk, California
Norwalk-La Mirada Unified School District

Former elementary school.

From loss of enrollment, is now leased to Los Angeles County Schools for use as a special school.

Buildings - Circa 1956 are cluster of separate units, 3-5 classrooms each, with a central courtyard.

Currently there are 100 special students.

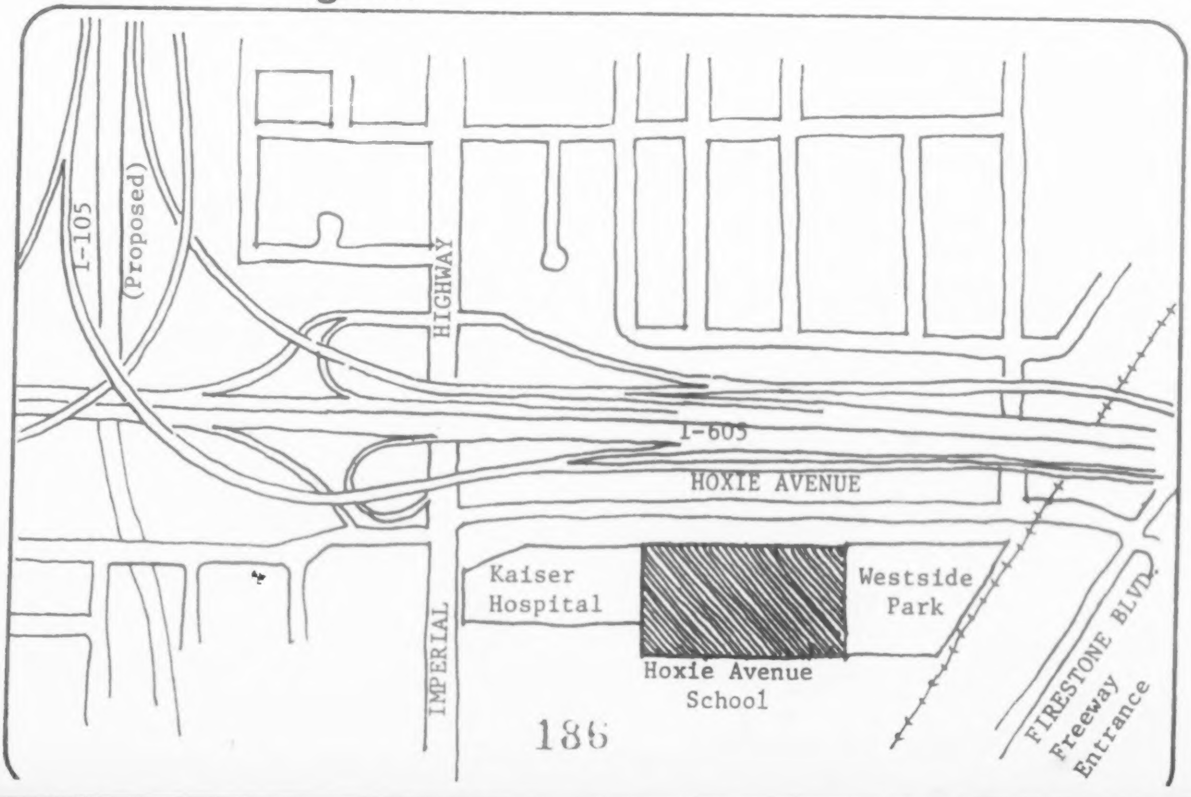
highway

I-105 (Proposed) and
I-106

I-605 - existing 8 lane Los Angeles metropolitan freeway.

I-105 (proposed) - provides 8 lane east-west link between Los Angeles International Airport and I-605. Has required widening of I-605 R-O-W at the Hoxie site for transition lanes to I-605.

situational diagram



I. SITUATIONAL CONTEXT

A. Highway

Two major highways are involved in this case. First, I-605, the San Gabriel River Freeway, passes approximately 300 feet west of the Hoxie site. Second, the proposed I-105 (Century Freeway) eastern terminus will intersect I-605 less than 2,000 feet from Hoxie. I-105 will add two approach lanes on the Hoxie side of I-605; I-605 presently has 8 lanes.

I-605 is elevated about 20 feet above grade where it passes the Hoxie Avenue School. A major interchange with the Imperial Highway is about 600 feet west of the Hoxie site. According to the latest design plans, I-105 at its terminus will pass over I-605 on an elevated curved ramp. The ramp will descend to merge with I-605 near the center of the Hoxie site. In addition, a lane will split from the approach ramp and pass closer still to the Hoxie site (approximately 250 feet). This additional lane will follow along the freeway for approximately 1,500 feet to intersect with Firestone Boulevard, a local street.

I-605 was constructed in 1966, ten years after the construction of the Hoxie Avenue School. I-105 has not been constructed and is being held pending environmental clearance.* Property acquisition for I-105 is approximately 75 percent complete.

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*For a more complete discussion of the I-105 delay, see Status of the I-105 Project, op. cit. Also see the case study for Los Angeles Southwest College.

B. School

Hoxie Avenue school was constructed in 1956 at a time when the Los Angeles area was experiencing its greatest population boom. Hoxie Avenue was originally a quiet residential street in the northwestern portion of the City of Norwalk. Time and the freeways have changed the character of Hoxie Avenue and the neighborhood. With declining enrollments, Norwalk-La Mirada Unified School District found it necessary to close the Hoxie Avenue Elementary School in 1974. In that same year, Los Angeles County schools leased the Hoxie Avenue School for use as a special education facility. Presently, the Hoxie School houses the special school program central administrative staff and provides classrooms for 80 elementary level and 20 secondary level students with speech or learning impediments.

C. Proximity Relationships

The Hoxie Avenue area has changed significantly in the past few years. The families that settled there in the 1950's are now older. Their children have grown past the elementary level. Both I-605 and the proposed I-105 freeways have also significantly altered the residential character of the surrounding area.

I-605 passes over the Imperial Highway about 600 feet west of the Hoxie site. At the point where it passes Hoxie, I-605 is elevated about 20 feet above grade. The existing freeway is about 300 feet in distance from the Hoxie School. The land surrounding the Hoxie area is flat. The drawing prepared by the Norwalk-La Mirada Unified School District, Appendix 3, will best illustrate the school layout

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itself. As can be seen, the administration buildings are along Hoxie Avenue. There is a large asphalted courtyard between the classroom buildings. Behind the classrooms, to the East and off the drawing, is a large grassy play area.

The situational diagram at the front of this case will best illustrate the proximity relationships. As can be seen, Hoxie Avenue passes on the west side of the school property. Further beyond is the I-605 freeway. The Imperial Highway, separated from the school by Kaiser Hospital, passes to the south. Imperial Highway is a major Los Angeles area arterial street that will be supplemented by the construction of I-105. The Hoxie Avenue school may be visualized as lying in the base of a triangle formed by Hoxie Avenue and with sides formed by the Imperial Highway and Firestone Boulevard. Local traffic which intends to travel north on I-605 must enter I-605 at Firestone Boulevard. Depending upon the place of origin, some of this traffic must travel down Hoxie Avenue past the school to get to the freeway.

Kaiser Hospital is located on the southern boundary of the Hoxie School. The hospital is located on the corner of Imperial Highway, but public access is via the parking lot entrance on Hoxie Avenue.

To the west, about three long blocks or over 2,000 feet away and on the other side of the freeway, is the San Gabriel River. This river forms the political boundary between the City of Downey and the City of Norwalk, in which the Hoxie School is located. It is also the Norwalk-La Mirada Unified School District boundary.

To the north and east, Firestone Boulevard runs in an approximately northwesterly direction, intersecting Imperial Highway some three fourths of a mile east of Hoxie School. Firestone Boulevard in the portion east of the San Gabriel river is fully contained within the political boundaries of the City of Norwalk; yet that same eastern portion forms, in the vicinity of Hoxie School, the northern boundary of the Norwalk-La Mirada Unified School District.

II. IMPACTS

A. On School

Both I-605 and I-105 have had a very significant impact on the Hoxie School through acquisition and clearance of large amounts of land within the school's service area. Thus, clearance caused a substantial drop in attendance and contributed to the closing of Hoxie as an elementary school. The freeway was not the only cause of the decline. Norwalk was a young community in the mid-fifties when Hoxie was built. The young couples who bought the houses are now twenty years older, so are their children. Declining birth rates have further constributed to fewer children in school. Nevertheless, the freeways have been the major contributors to declining enrollment, not only to Hoxie, but district wide - the Santa Ana Freeway, I-5, also passes through the School District boundaries.

I-105 has had the bigger effect on the Hoxie service area, since it cleared a new path and required widening the I-605 right-of-way. All told, approximately 210 housing units of the estimated 600 housing units in the Hoxie area have been cleared by both freeways.

CalTrans in the I-105 EIS has measured the existing I-605 noise levels at 63 dBA. I-105 is expected to raise these to 67 dBA. State standards call for noise abatement measures when 50 dBA is exceeded. In fact, Hoxie is included in the CalTrans noise abatement program described in Appendix 1. The noise at Hoxie is particularly acute since I-605 is elevated where it passes the Hoxie site. Little relief is afforded by the Hoxie School site plan (Appendix 3) which consists of separate buildings parallel to and four to five deep from the I-605 freeway. Since the school was built in 1956, there is no sound-proofing nor are any of the buildings air-conditioned.

Interestingly, the only complaint made by the school users to CalTrans, concerned pedestrian access from the west side of I-605. At one time CalTrans, with the encouragement of the School District, was studying the feasibility of a pedestrian tunnel. Later a pedestrian overpass was considered more feasible and plans were underway. Declining enrollments caused the District to close the school, however, and the pedestrian access is no longer needed, since special students generally come by car from every part of the Norwalk-La Mirada District.

I-105, if built, will increase the noise levels at Hoxie. Two lanes will be added on the Hoxie side for traffic coming from I-105 and either merging to I-605 or taking the Firestone Boulevard exit. These merging lanes will also be elevated above grade, exacerbating the effects of freeway noise to the Hoxie School.

Two traffic related impacts were mentioned, though none of the respondents saw them as overly significant. Some local traffic, to travel north on I-605, will use Hoxie to reach the Firestone Boulevard on-ramp. The Kaiser Hospital, located adjacent to Hoxie School on the Imperial Highway corner, further increases traffic in the vicinity of the school. But now, since the school is operated for special students, most of whom do not walk to school, traffic passing on Hoxie Avenue is no longer a problem.

Then there are the not so easily identifiable impacts attributed in part to the freeways. The location of Kaiser Hospital and other land use decisions undoubtedly were made in part reference to the location of the freeways. And in the Norwalk-La Mirada area, other changes are beginning to take shape. As the housing, composed primarily of 20 year old three bedroom, one-bath stock ages more, socio-economic changes are occurring. There are indications that lower-income minority populations may be moving into the area. Thus, the trend in declining enrollments could reverse, and the area would once again be witness to increasing enrollments from the typically larger families of these groups. Too little is known of the role which freeways play in these changes, but certainly they are contributors as significant elements of the urban environment.

B. On Highway

Hoxie Avenue School has had virtually no impact on either I-105 or I-605. Discussions between CalTrans and school users related to pedestrian access are an exception, as are noise abatement measures which may result if I-105 is built. In fact, Los Angeles County Schools, which now leases Hoxie for both a Special School and to house the County Special School staff, is preparing a request for noise abatement aid from CalTrans.

The Special School uses only a portion of the Hoxie School, namely the administrative buildings and some seven classrooms. Currently, Los Angeles County Schools plans to air-condition the administrative units only. The California Noise Abatement Program is described in Appendix 1. There are no funds presently available to implement the program.

III. MITIGATION

A. Measures Proposed

When Hoxie was still an elementary school, through 1974, the Norwalk-La Mirada Unified School District had requested that some type of pedestrian access be provided to students living across I-605 from the school. Since Hoxie became a special school in 1974, the pedestrian access was no longer needed.

CalTrans, as part of the California School Noise Abatement Program, measured the level of noise in all state schools affected by freeway noise. A list was compiled of those schools needing abatement measures, and Hoxie is on this list. Until the recent proposal by the Los Angeles County Schools to air-condition the administrative portions of the Hoxie School, there have been no local noise abatement efforts. In part this is because the School District, faced with declining enrollments, has experienced budget cutbacks each year: School District funding from the state is based upon total district average daily attendance. Even the recent air conditioning plans by Special School staff appear only in part to be directed towards noise abatement, since classrooms are not included in the plans. In addition, Los Angeles County Schools may have little interest in any large capital improvements to the Hoxie School since the facilities are leased from the local district.

B. Measures Implemented

Hoxie was closed as an elementary school. No further mitigation measures have been implemented for the Hoxie Special School.

IV. SUMMARY AND RECOMMENDATIONS

A. Lessons Learned

In their report on I-105, the multi-disciplinary team of consultants specifically pointed to the need for local planning. That need is clear in the Hoxie case. Some form of local transportation planning compatible with local land use goals could have aided freeway planners. Yet, with the high rate of growth Los Angeles was experiencing and the rather naive view of freeways, it is difficult to imagine that the present situation at Hoxie could have been avoided. Still, other localities may learn from the Hoxie case.

School District planning cannot occur in isolation and there is a need for better local planning. Yet, the burden of responsibility more logically falls upon the freeway planners. After all, it was the freeways which contributed to the large decline of enrollment, and this decline in enrollment has decreased the dollars the School District receives from the state each year. With such a drastic percentage decrease in attendance in any one school service area (over 33 percent in the Hoxie case), some form of freeway aid to the district is clearly called for and in advance of the actual taking of right-of-way.

There are other more obvious lessons. The type of school construction, separate buildings around a central courtyard, is not adequate for schools impacted by noise. Of course, Hoxie was built prior to the freeway. State building requirements at that time would not allow for any deviations. Of course, this has changed, just as the environmental awareness has increased. This is particularly true in California and areas which have had experience of higher growth. Other areas may still be in the position in which Hoxie found itself in the late 1950's and even through much of the sixties.

B. Suggestions

The school users feel that some form of aid is necessary to a School District when, as in the case of Hoxie, school attendance is severely impacted. The other need is for noise abatement funding, since most School District budgets, especially those already impacted by freeways, cannot absorb the high improvement costs required to adequately attenuate freeway noise.

CHRONOLOGY - HOXIE AVENUE SCHOOL

1956	Hoxie Avenue School built.
1961 (Approx.)	Property acquisition for I-605 began.
1965	The California State Division of Highways (CalTrans) began route location studies on the East Portion of I-105.
1966	Construction of I-106 completed.
1967	Division of Highways held first public hearing on the East Portion of I-105.
1968	Highway Commission holds first public hearing on the East Portion of I-105.
1974	Norwalk-La Mirada Unified School District closed Hoxie Avenue Elementary School.
1974	Los Angeles County Schools leased Hoxie Avenue School from Norwalk-La Mirada to operate as a special school for children with speech or learning difficulties.

PERSONS CONTACTED: HOXIE AVENUE SCHOOL

Mr. Bruce Butler
Business Manager
Norwalk-La Mirada
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Norwalk, Ca. 90650

Responsible for School District management as well as coordination of school planning.

Interviewed in person.

Mr. Philip D. Geer
Facilities Coordinator
Office of the Los Angeles County Superintendent of Schools
9300 East Imperial Highway
Downey, Ca. 90242

Responsible, in this case, for the selection of Hoxie Avenue school as a Los Angeles County special facility, obtained by lease from the Norwalk-La Mirada School District.

Interviewed in person.

Mr. Dan Gable
I-105 Project Engineer
CalTrans
120 South Spring Street
Los Angeles, Ca. 90012

Responsible for planning of the Hoxie area portion of the proposed I-105 freeway.

Interviewed in person.

Dr. Jeffrey Heller
Director
Hoxie Avenue Special School
Los Angeles County Schools
12324 Hoxie Avenue
Norwalk, Ca. 90651

Director of the special education program (aphasia and remedial speech) operated by Los Angeles County at the Hoxie Avenue School.

Interviewed in person.

case study background data

school

Fiesta Gardens
1001 Bermuda Drive
San Mateo, California
San Mateo City Elementary School District

Grades K-5, 409 students

Constructed 1955, addition 1970.

Single story, wood frame and stucco with covered exterior circulation

highway

California 92 and U.S. 101

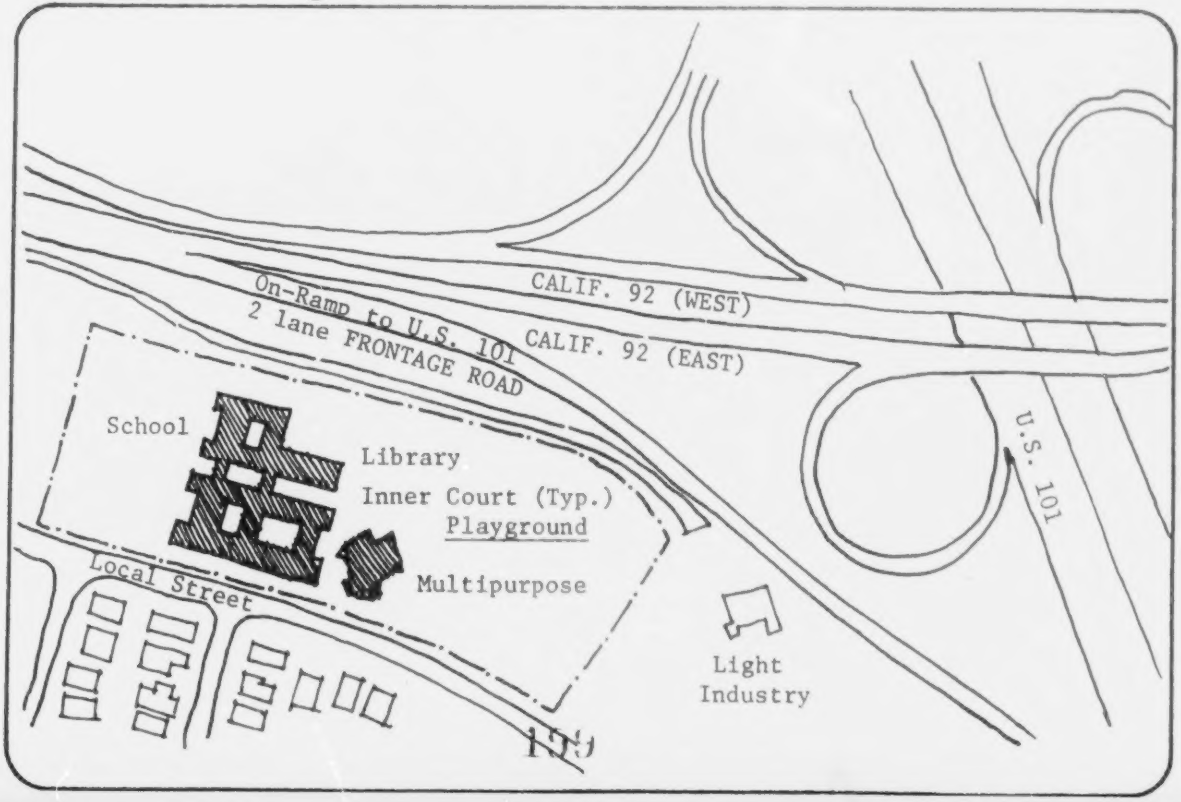
4 lane partially completed freeway.

2 lanes on 20 foot high structures, 2 lanes at grade. 4 lane county road at grade when school opened.

ADT: 45,000 (1975) 37,000 (1971).

Speeds: 55 mph and acceleration from nearby on-ramp.

situational diagram



I. SITUATIONAL CONTEXT

A. Highway

The highway which impacts the school is State Route 92, although the boundaries of the school site are also within 500 feet of U.S. 101, a major eight-lane freeway. Route 92 was originally a four-lane county road, 19th Avenue, at grade and directly adjacent to the north boundary of the school site. A cloverleaf interchange was constructed in 1955 at the same time that U.S. 101 was completed. The school was constructed in the same year to serve a new subdivision near the intersection of the two highways. In 1968, Route 92 was improved to a four-lane freeway on structure, starting at a point some 1,000 feet to the west of the school site and continuing in that direction. At that time it was planned to improve the segment of Route 92 adjacent to the school in the same manner by raising it onto structure and thereby enabling the eventual construction of a full freeway to freeway interchange at some future time. The first phase of this segment was completed in 1971 and involved the construction of two eastbound lanes, those nearest the school, on structure, as well as the construction of an elevated on-ramp connected to U.S. 101 southbound. Peak and average daily traffic have increased approximately 40 percent within the past five years.

Route 92 is within the jurisdiction of the California Department of Transportation (CalTrans). The adjacent school, therefore, qualifies for noise abatement improvements provided through the CalTrans school noise program which is described in detail in the Appendix.

B. School

The Fiesta Gardens School is part of the San Mateo Elementary School District, which has approximately 14,000 pupils. It is a single story, wood frame building with 18 classrooms, a library, and a large, detached general purpose room. All circulation between classrooms is by means of covered outside walkways. All classrooms have at least one wall which is primarily glass and, where possible, oriented towards an open patio area shared with two or four other classrooms. Most window walls face north in order to minimize heat gain and glare. The noise source, Route 92, is also to the north. Each classroom has an individual heating/ventilation unit. Doors and windows must be opened on the warm days which occur in every month in this climate.

As initially constructed in 1955, the school had ten classrooms. Eight additional rooms were added in 1960 and sited to the north of the original building. A detached air-conditioned and windowless multipurpose room was added in 1970.

The enrollment of the school is now approximately 400 pupils, K-5. Most children walk from homes in the immediate neighborhood, which is effectively isolated from the rest of the city by the two freeways, a county fairgrounds, and a mainline railroad. Because of this relative isolation, traffic on local streets near the school is very light. A few pupils live outside the immediate neighborhood. In the past, significant numbers of children were bussed from Foster City, a very large planned unit development some two miles away. This has ceased as an additional elementary school has been built in the development.

The pupil yield in the neighborhood immediately adjacent to Fiesta Gardens has been decreasing in recent years and there is presently excess classroom capacity at the school. This situation is expected to reverse shortly as nearby homes are sold to younger families with more elementary school age children. Therefore, in spite of the noise impact, the School District plans to continue to operate a school on this site.

C. Proximity Relationships

The topography of the surrounding area is flat, the major visual landmark in the area adjacent to the school being the raised structure of Route 92. This roadway is elevated approximately 15 feet and forms a very definite visual north edge to the neighborhood. There is a two-lane frontage road running parallel to Route 92, directly adjacent to the north edge of the school site. This was the location of Route 92 before it was raised on structure. The classrooms nearest to Route 92 are 163 feet from that part of the roadway structure which is the on-ramp connecting Route 92 to U.S. 101. The school site and its adjacent neighborhood are, as mentioned above, completely isolated from traffic going to or coming from either freeway. Vehicle access from the school to the freeway is circuitous but not inconvenient. A few children come from the neighborhood to the north of Route 92 and can walk along a street which crosses under the freeway. No children come from either east or west of the immediate neighborhood.

The neighborhood served by the school is comprised primarily of single family homes, except for a small garden apartment development next to the school. Nearby neighborhoods are a mix of residential, light commercial and sub-regional retail uses.

II. IMPACTS

The primary impact of interest is highway noise. There are potential problems of pedestrian access to other residential neighborhoods as well.

Noise became a problem at Fiesta Gardens during the early 1960s as traffic increased on Route 92 due to the growth of the surrounding suburban areas which this highway connected to U.S. 101, then the only freeway taking commuters to employment centers to San Francisco in the north and to the south.

It was not until 1966 that the School District accumulated sufficient funds to replace the original north-facing window-walls with heavy mass wood frame insulated walls and installed additional mechanical ventilation to compensate for the loss of openable windows. At the time noise measurements were made by CalTrans in 1973, the peak noise from the highway was measured as 61 dBa, well above the state noise abatement program qualifying limit of 50 dBa. Later investigation showed that although the walls were adequately modified, a significant amount of noise is still entering these classrooms through the fairly lightweight roof structure.

The impacts of highway-related noise have been debilitating to the educational process at Fiesta Gardens in a variety of ways. Even with doors and windows shut, there are occasions when traffic noise, particularly sirens from emergency vehicles, is very distracting. As the school is not air-conditioned and the climate is mild, there are many days during the year when it is necessary to open doors and windows because of the heat. On these days, the noise of trucks or emergency vehicles forces teachers to stop talking and causes the students to yell. The principal has observed that those teachers in classrooms nearest the freeway appear to be more tired and strained at the end of the day. Another observation was that the students' behavior when outside, either on the playground or on the patio for lunch, tends to be more aggressive than that of students at other schools because of the continual need to yell in order to be heard.

Highway-related noise has defeated the use of the most important feature of the school's functional design; the use of the outdoor patios adjacent to the classrooms. The climate permits the use of these areas most of the year and this has the effect of increasing the amount of available classroom space. The School District has the policy of providing paid Aids for each classroom and therefore adequate staffing is available to make full use of these outside areas as an extension of the space available for education. These court spaces have hard wall and floor surfaces which tend to amplify the noise which is introduced into them; therefore the open doors and windows, which may not be in direct line of sight to the highway noise sources, still admit a great deal of noise.

A relatively minor actual impact resulting from the proximity of the highway(s) and the school is the restricted pedestrian access to the school from residential areas on the other side of both Route 92 and U.S. 101. This has had the beneficial aspect of insulating local streets near the school from all but local traffic so that the walk to school for children living in the immediate neighborhood is very safe. The negative impact associated with this proximity stems from the problems of pedestrian access for any students who do not live in the immediate neighborhood. There are several who come from the area to the north of Route 92 whose parents drive them to school. This is because the walk would take them along a heavily traveled boulevard and require crossing an on-ramp and an off-ramp at their intersection with the boulevard. Both of these intersections have traffic lights, but appear to evoke generalized fears about students' safety.

A further implication is that as enrollment patterns change as they have in the past few years at Fiesta Gardens, and the pupil yield of the immediate neighborhood shows a significant decline, it becomes necessary to bus children or have their parents drive them. This is because the freeways have the effect of forming a barrier either in fact, or in terms of parents' perceptions, to allowing the students to walk. The ability of the School District to redistribute pupils among the schools in the District as a response to changing enrollment patterns is thus restricted.

III. MITIGATION

A. Measures Proposed

All the mitigation measures proposed for Fiesta Gardens have been related to the noise problem. All measures taken were in response to the staff of the school, with secondary support coming from school parents. There is no information available concerning the planning and decision-making process in 1966 when the School District made initial modifications to those five classrooms closest to the newly constructed Route 92. According to later measurements, these modifications were unsuccessful from the standpoint of noise reduction as well as defeating the indoor-outdoor functional relationships which the building was designed to enhance.

The second round of proposals for mitigation have been made in response to the CalTrans school noise abatement program (see Appendix for a complete description of this program). Soon after the state legislature passed the bill authorizing CalTrans to pay for any modifications necessary to mitigate the interior noise levels in schools which were over a peak of 50dBa in schools built before the highway, the School District decided to make investigations to determine whether Fiesta Gardens would qualify. On the basis of the results from these first investigations, the District requested that the school be included in the program. Subsequent measures by CalTrans indicated that certain classrooms would not qualify and the school principal requested that measurements in some of these rooms be made again. Further tests indicated that these rooms did in fact qualify.

The school board notified CalTrans of its desire to participate in the program in December 1973, but it wasn't until September 1974 that a cooperative agreement was executed between CalTrans and the District. This agreement authorizes the School District to spend up to $36,000 for preliminary planning and cost estimates, for which sum they would be reimbursed by CalTrans. The agreement also stipulates that the work to be done is restricted to that required for noise attenuation and therefore floor coverings and lighting fixtures are excluded. The $36,000 limit on planning fees is arrived at as a percentage of a ball-park estimate of the eventual construction contract amount.

The scope of the cooperative agreement is decided upon by CalTrans after a first-cut examination of the relative feasibility of either, or some combination of, modifications to the highway or the school. The typical highway-related modification is a noise wall extending at least eleven feet above the roadway in order to shield truck exhaust noises. This solution was ruled out as infeasible because the road was already on structure which had not been designed for such an additional load. The cooperative agreement was therefore drafted with the assumption that all required attenuation would have to be achieved through modifications to the building.

The typical approach to building modification as suggested by CalTrans for achieving the necessary attenuation involves a combination of air conditioning, sealing and caulking some windows while replacing others with sold infill, and adding mass to doors and walls. The School District staff and the teachers felt that this approach would not accomplish one of its essential purposes, regaining the use of the exterior courtyards. The thought of relatively windowless air-conditioned classrooms had no appeal, particularly in a building that was intentionally planned to be otherwise.

It appears that there was simultaneous agreement between the school architect, the principal, and the assistant superintendent that the best approach would be to cover the court areas with something that would keep the noise out, but allow for as much natural light and ventilation as possible. As all classrooms, except the four which had been modified in 1966, faced onto a court with both windows and doors, and most walls which were not part of a court were already blank, this would eliminate the need for further building modifications and allow use of the courts at the same time.

The District's architect, in collaboration with acoustical and mechanical engineering consultants, developed preliminary plans which were presented to the staff and parents of the school in June 1975. Certain detail modifications to circulation and window orientation were made on the basis of that meeting. Final preliminary plans and cost estimates were then submitted to CalTrans in September 1975 after extensive investigation of the cost effectiveness of alternative combinations of ventilation and air conditioning systems and material choices for the courtyard enclosures. The final estimate for construction as of May 1976 was $361,000, including $311,000 in paid construction costs and some $40,000 in architects' and engineers' fees.

The scope of the work proposed by the District architect is outlined below to give some indication of what is required.

The north wing of the school is the one closest to Route 92. Three of the six classrooms in this wing had noise levels of 61 dBa, even after having had all windows on their north exposure replaced with insulated walls in 1966. The proposed modifications to all six rooms are designed to reduce noise levels by 12 to 15 dBa.

- Existing acoustic tile ceilings to have mass added by means of an additional layer of gypsum board. Sound baffle walls to be constructed in front of the entry door of one classroom closest to the highway.

All exterior doors to be replaced with solid core doors and gasketing. Exterior furnace air intakes provided with sheet metal and insulation sand baffles. The covered exterior walkway connecting these classrooms to be enclosed. All classrooms to be air-conditioned because adequate noise baffling of a ventilation system is infeasible.

The south wing of the building has ten classrooms, a library, and offices. Four classrooms do not qualify because their noise levels are acceptable and the library is presently air-conditioned. The modifications to the other classrooms are designed to reduce noise levels by 5 dBa.

- The primary means proposed for noise attenuation will be to cover all of the existing outdoor courts with saw-tooth roofs with clerestory windows. Windows facing north in this wing are to be sealed and caulked. Classrooms to be pressurized by ventilation which is then directed out through the court roofs in order to prevent heat build up.

The School District desires to install outdoor carpeting and lighting in the enclosed courts; but according to CalTrans policy, these are considered to be improvements to the building and therefore not eligible within the intent of the state noise abatement program.

B. Measures Implemented

All work in the school noise program has been held in abeyance since mid-1974 because of severely limited funding. Available funds have only been directed to complete preliminary planning work which had been started prior to that time. When funding is again available, which may not be until 1978, CalTrans will authorize the School District to pay for the preparation of contract documents, to put the project out to bid, and to contract for the expenditure of construction funds for which it will be reimbursed as work progresses.

IV. SUMMARY AND RECOMMENDATIONS

A. Lessons Learned

The most important lessons have been related to the process of planning the improvements for noise abatement. These include the following:

- Noise abatement modifications can be very costly, particularly with a building such as Fiesta Gardens that was designed to maximize the interface between indoor and outdoor spaces and functions. At an estimated cost of at least $361,000 or $20,000 per classroom, these modifications are almost one-half the cost of a new building. This is a classic example of the price paid for not coordinating the planning of school and highway improvements; although in this particular case, the circumstances leading to the present impacts might not have been foreseeable within typical planning horizons.

- The cost of effective noise abatement modifications will often be beyond the financial resources of individual school districts. In the absence of a fairly large and costly program administered on a state or regional basis, it will not be possible to deal with these problems.

- There may be conflicts over the appropriateness of different improvement strategies, depending upon the apportionment of first versus life-cycle costs. This is the case when air conditioning a building is the least expensive modification from the point of view of the agency paying for capital improvements which it is, at the same time, the most costly alternative in the eyes of the agency (usually School District) paying operating and maintenance costs.

- It is important not to lose sight of the ultimate goal of negative impact mitigation measures--the improvement of the physical setting for the educational process. A concerted effort is needed to assure that in the process of mitigating one negative impact, in this case highway noise, other negative impacts are made on the educational setting. In this case the school could have lost naturally lighted classrooms and the possible use of adjacent outdoor learning spaces and increased the incidence of teacher and pupil illness due to air conditioning in a climate where this would normally have marginal usefullness during the school year.

- It is difficult to determine the exact scope of necessary modifications when it comes to noise abatement. The most controverted improvement is carpeting, which is typically viewed as an unrelated and unnecessary improvement to the building, although its sound absorbing qualities may be as effective in combating noise distraction as sealing and caulking windows, for example.

B. Suggestions

The major suggestion for improving the noise impact mitigation process, which came from both the school and highway related respondents, was that a program of this magnitude should not be put in motion without adequate funding to ensure its implementation. No one suggested how this might be possible, given the highly political context in which highway gas tax funds are allocated. This problem is discussed further in the Appendix.

The other suggestion related to the importance of correlating objective and subjective findings of impact. Several classrooms at Fiesta Gardens had objective noise measurements which were borderline in terms of the noise program guidelines, but which the users felt were as badly impacted as any others. This may be due to particular types and frequencies of noise such as sirens or trucks which may require special mitigation, while other types of noise may be acceptable. The subjective analysis is important because noise impacts are experienced on a subjective basis.

CHRONOLOGY--FIESTA GARDENS SCHOOL

1955 School constructed to serve tract of new homes. Located adjacent to State Highway 92, then two lanes and at grade. Construction of Interchange of 19th Avenue (now State Highway 92) and U.S. 101 completed.

1966 Three classrooms nearest to highway are modified for noise attenuation. The work involved replacing window-walls with solid material and installing mechanical ventilation at a cost of $40,000.

1967 Rt. 92 improved to Freeway starting at a point to the west of school site. Traffic flow increases past school.

1971 First phase of Rt. 92 improvement completed, parallel to existing roadway and adjacent to school. Road and new on-ramp connecting with U.S. 101 constructed adjacent to school on 20-foot structure. Noise impact immediately felt by school.

1973 School District learns of State Department of Transportation (CalTrans) School Noise Abatement Program and hires acoustical engineer to determine whether school qualifies, then notifies CalTrans of the results and asks to be included in the program. CalTrans makes own noise measurements in March, and again during the summer. School Board authorizes participation in the program in December.

1974 Cooperative agreement entered into between CalTrans and the School Board in October for preliminary planning of noise abatement measures.

1975 Schematic plans approved by School District staff in June. Final plans and related cost estimate as negotiated is presented to CalTrans in September. This estimate projects a contract award date for construction of school improvements at any time between January and June 1976.

1976 CalTrans informs School District of the unavailability of funds for the project and informally suggests construction may have to wait until 1980.

PERSONS CONTACTED: FIESTA GARDENS SCHOOL

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case study background data

school

R. P. Harris
Houston, Texas
Houston Unified School District

K-6, 620 students
1958
Single story, reinforced concrete and brick.

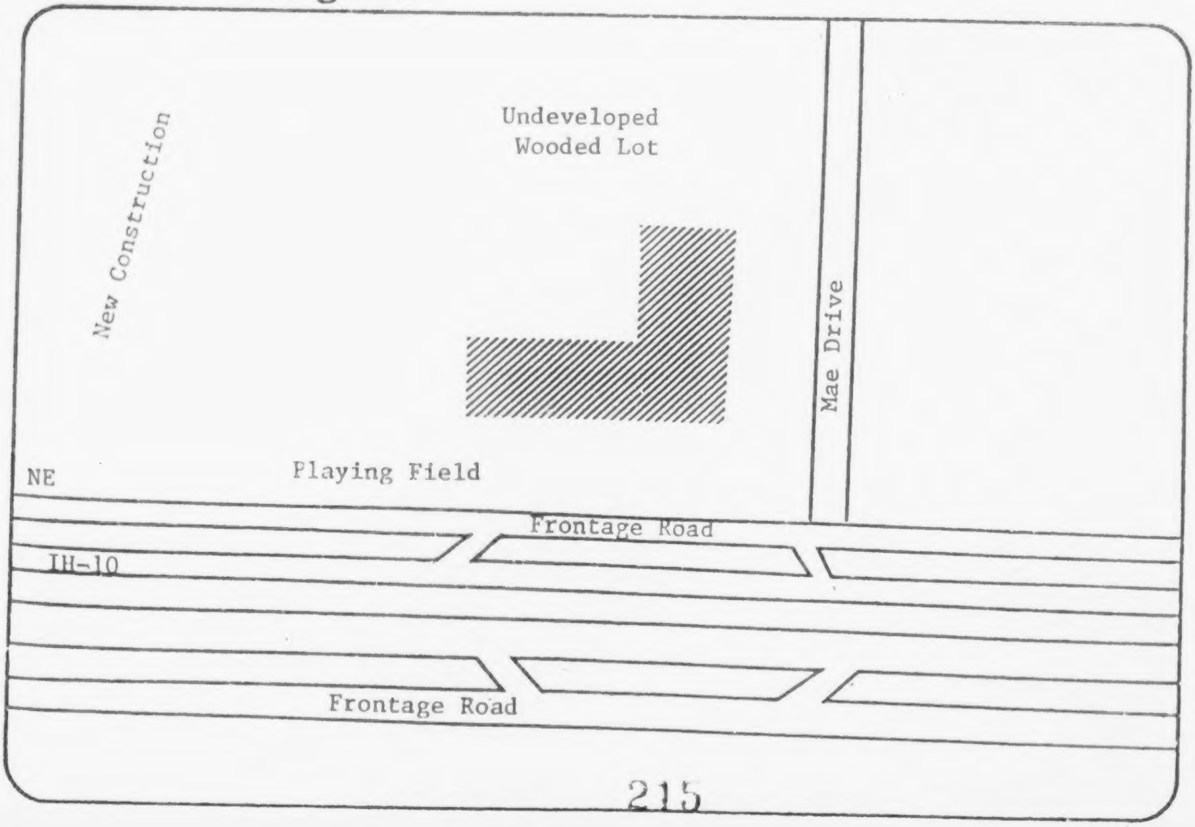
highway

IH-10

IH-10 - 4 lane freeway is major interstate trucking route, with frontage roads located at grade with the school.

ADT 88,000

situational diagram



I. SITUATIONAL CONTEXT -- HISTORY AND CURRENT STATUS

A. Highway

R.P. Harris School site is adjacent and parallel to the frontage road of IH-10. The four lane freeway was constructed in 1953. The estimated average daily traffic is currently 88,340. The highway is a major interstate trucking route to the industrial complex (Houston Ship Channel) several miles north of the site and many of the trucks traveling the roadway carry explosive or corrosive chemicals. The speed limit on the frontage road is 35 miles per hour except during school hours, when it is reduced to 20 miles per hour. Respondents noted that this limit is not observed by drivers. The highway and frontage road are located at grade with the school as is Mae Drive, a local residential street which serves as the primary means of vehicular access.

B. School

R.P. Harris Elementary School was constructed in 1958 on a site occupied by a temporary wood frame school built in 1948. The single story structure is reinforced concrete and brick. The building is L-shaped, with the auditorium, lunchrooms, and administrative offices in the wing furthest from the freeway. There are thirteen classrooms on either side of a double loaded corridor, in the wing facing the freeway. Six of these thirteen classrooms face the freeway. Nine temporary classrooms are located on the southwest corner of the site. The school and temporary classrooms were air conditioned in 1970 as part of a district-wide program.

The school presently serves 620 students in kindergarten through sixth grades. The students are sixty-four percent white, twenty percent black, and fourteen percent Hispanic.

C. Proximity Relationships

The freeway, frontage road, and school site are all at grade and the surrounding area is relatively flat. The school building is within 100 feet of the edge of the freeway roadway at the northeast corner. The six acre school site is bounded on the north by the frontage road parallel to the freeway. A playing field is adjacent to this frontage road and is separated from it by a fence. There is no fence between the frontage road and the freeway itself. The south side of the site is bounded by an undeveloped wooded lot; the west side by land being cleared for new construction; the east side by Mae Drive, a residential street with little traffic which serves as the school entrance.

Although the school serves neighborhoods on both sides of the freeway, almost ninety percent of the students now come from neighborhoods on the far side of the freeway. Of this ninety percent, sixty percent walk to school by crossing under the freeway at Federal Road three blocks east of the site. Twenty-six percent pay for a private bus service, being ineligible for public service under Texas law because they live within a two mile radius of the school. Sixteen percent of the students are bussed to school by the School District. A pedestrian overpass is under construction which will connect the school grounds with the opposite side of the freeway.

Vehicular access to the school from the opposite side of the freeway is complicated by the limited number of crossing points and the fact that the frontage road is one-way.

The neighborhoods surrounding the school have and continue to experience rapid population growth as they serve as an entry point for many recent migrants to the Houston area. The school's enrollment has almost doubled over the past ten years. It is one of the few schools in the District where enrollments are still growing. During the last ten years, six apartment complexes and four single family subdivisions have been constructed within the school's attendance service area. Approximately one-half of the parents work in the Channel Industrial Complex, four miles north of the school site.

II. IMPACTS ON SCHOOL

Summary: The major impacts of the freeway on the school site are pedestrian safety, danger of truck wrecks and explosions, and constrained access to the site. Distraction caused by the freeway and the noise generated by the traffic are perceived as minor impacts.

A. Noise

Freeway noise on warm days when classroom windows would be opened for ventilation was a problem before air conditioning was installed. Air conditioning was not provided in response to the noise problem, but was a part of a districtwide program to air condition all 200 schools in the Houston area. Currently, noise has little effect upon the main building and none upon the more distant temporary classrooms.

B. Air Pollution

Air pollution on the site is not a result of the freeway, but of the industrial aerial discharges from the Houston Ship Channel industries.

C. Distraction

Six classrooms have floor to ceiling windows facing the freeway. The freeway is perceived to be a significant source of visual distraction for students in those classrooms. Normal traffic is a minor distraction; an accident creates a major distraction as the children get excited and classroom routine can be disrupted for up to three hours. Teachers in these classrooms try to minimize the distraction by keeping window shades down on these windows. They also attempt to incorporate the freeway, its function, traffic, and activity into their lesson plans wherever possible.

D. Pedestrian Safety

Although there have been no accidents involving R.P. Harris students since 1961, pedestrian safety continues to be an issue among the staff and parents. Although the school yard is fenced, the perimeter of the freeway is not and there is no headlight barrier on the median strip. School staff report that children play on the slopes of the freeway next to the frontage road, especially before and after school, when there is no ground supervision. They report children go out onto the freeway at least once a month.

The major pedestrian route from the far side of the freeway is Federal Road. There are no crossing guards at the Frontage-Federal Road intersection because the Police Department will not authorize crossing guards where there are traffic signals. Parents and older siblings walk many younger children to school who must use this route because of parental concern for their safety.

E. Truck Explosions/Wrecks

In 1976, Houston attracted national attention when a tanker truck carrying ammonia went out of control on an elevated freeway and crashed through a guard rail. The National Highway Safety Board investigation determined that the accident occurred because (a) the driver failed to obey the speed limits and (b) the speed limits were not enforced. This accident exacerbated staff and parental concern that the large number of trucks carrying explosive petrochemicals and corrosive liquids and gases to the industrial area south of the school could crash and explode near the school. They reported that they feel the school is sitting on a "keg of dynamite" because trucks constantly exceed the posted speed limits on the freeway segment adjacent to the school.

F. Access to School

Construction of IH-10 made this area a prime location for residential development. The majority of that development that took place in the school's service area occurred on the far side of the freeway. The limited traffic crossings and one-way configuration of frontage roads makes travel distances from home to school substantially greater than the most direct route between those two points. In Texas, in order to be eligible for free public transportation to school, a child must be geographically more than two miles from the facility. Those children who live within the boundary must walk or pay for private transportation even though the distance they must walk to get to school exceeds two miles. In the case of R.P. Harris, children who can afford the cost use private bus transportation. Those who cannot afford the additional cost walk.

III. MITIGATION MEASURES

The following mitigation measures have been proposed:

A. Noise

No actual mitigation measures were proposed to deal with the noise level problem by either staff or central office personnel. However, in 1970, the Houston Independent School District air conditioned the school as part of its districtwide program to reduce the impact of heat on the learning environment. The District does not perceive the noise resulting from the school's proximity to the freeway to be a problem. The school staff, on the other hand, feels highway-generated noise was a major problem. The air conditioning was a major factor in the reduction of the negative effect of freeway noise upon the classrooms in their opinion. Currently, the School District has one week in the fall and spring when air conditioning is not permitted, to reduce energy consumption. When the air conditioning is turned off and the windows are opened to cool the classrooms, noise becomes a source of complaint.

B. Air Pollution

No mitigation measures have been implemented. The District has not considered electronic filters because of the high cost of installation and maintenance.

C. Distraction

Teachers keep the shades down and attempt to work the freeway into their lesson plans in an attempt to minimize the distraction.

D. Pedestrian Safety

After five years of pressure by the school PTA, the Texas Highway Department has committed itself to build a pedestrian overpass over the freeway and frontage roads which will connect the campus with the residential areas on the other side of the highway. The Highway Department's decision surprised the PTA because they had received no prior notification that the Department was seriously considering their request. The Highway Department required the School District to cede property on the campus and a private commercial property owner to provide property on his parking lot to provide the landing pads for the overpass. The overpass will be completed before September 1977 and it is estimated that many of the children who live in the Yorkshire Village, Birchbrook, Whispering Pines, Rolling Wood and Holiday Forest apartment complexes will stop riding the private bus to school and will walk via the new pedestrian overpass. The PTA has also requested that posted speed limits be established on the frontage roads, that crossing guards be assigned to the Federal Road crossing, and that stop lights be installed at the corner of Fleming and Maxey Streets. No action has been taken on these requests at the present time.

IV. SUMMARY AND RECOMMENDATIONS

A. Lessons Learned

- It is unclear why the Houston Independent School District chose to construct a new school on a site that was in such close proximity to a major freeway linking Houston and its expanding heavy industrial area. The freeway has heavy truck traffic, often carrying explosive or caustic chemicals and the four lane freeway is being expanded to six lanes in each direction. Since the school was constructed five years after the freeway was opened, the School District might have designed the structure to minimize the impacts of the freeway on the learning environment. An explanation could be the fact that at the time the school was being planned and under construction, the District did not foresee the problems inherent in locating a school in such close proximity to a major freeway.

- From this case it is clear that School Districts considering locating a new school adjacent to an existing or planned freeway should insure that the site plan and building design proposed for the site incorporate the elements that are well established as mitigating measures (i.e., locating the classroom wing furthest from the freeway, blank wall construction if walls fronting on the freeway, and the like). Early consultation with the Highway Department concerning future expansion plans is also shown to be a desirable procedure. Further, early consultation with City departments charged with school safety programs (Police Department or Traffic and Transportation) should be undertaken to insure that pedestrian routes utilized will meet school requirements as well as minimum safety requirements.

B. Recommendations

- State highway departments should consult and coordinate their highway route and expansion planning earlier with school districts where existing or proposed school sites may be impacted by such freeways.

- School districts should appraise highway departments of major expansion and rehabilitation work at school sites close to freeways to ensure that (a) these expansions do not conflict with future highway department plans and (b) the design of new facilities mitigates as many of the negative impacts of freeways as possible.

- School districts should have a local coordination mechanism with the police, traffic, public works department and a state highway department liaison to identify and resolve unsafe traffic sutations created by close proximity of freeways to school districts and possible accident risk to children in the area.

- Local school departments should explore planting trees along the perimeter of school grounds to act as a noise, sight and air pollution barrier.

- School districts define school service area boundaries on other than a strict radius basis to mitigate the impact of freeway and other access constraints.

Chronology	IH-10 (Baytown Freeway)
1946	SH-73 designated as four lane divided freeway.
1948	Construction of four lane SH-73 begins. Temporary wood frame school constructed.
1952	SH-73 opened without access roads and with limited grade separations.
1957	Initial public hearing concerning the incorporation of existing State Highway 73 into the Interstate system as part of the route of Interstate Highway 10 -- with the understanding that with some minor additions, it would meet "tolerable" Interstate standards and would be upgraded to full Interstate standards at a later date (prior to the completion of the Interstate system).
1958	Construction of R.P. Harris Elementary School.
1966-67	Design studies and coordination with Federal Highway Administration regarding proposed upgrading.
1968	Pedestrian overpass of IH-10 requested by Principal of R.P. Harris Elementary School; recommended by Texas Highway Department; Federal cost participation denied by Federal Highway Administration.
1969	Pedestrian overpass resubmitted to FHWA by THD. FHWA approves Federal cost participation.
1970	Geometric design drawings of proposed upgrading submitted by THD and approved by FHWA.
1971	Negative Environmental Declaration submitted by THD and approved by FHWA.
1972	Design public hearing held and project report submitted to FHWA by THD.
1973	Upgrading project approved by FHWA. Right-of-way acquisition begins.
1974	Schematic layouts of proposed signing submitted by THD and approved by FHWA.
1975	Preparation of construction plans.
1976	Submission of project noise analysis by THD and approval by FHWA. First stage construction contract awarded for bridges at Greens Bayou but includes pedestrian overpass at R.P. Harris Elementary School.
1978	Anticipate contract for final work to upgrade IH-10 to full Interstate standards.

case study background data

school

Dodson
Houston, Texas
Houston Independent Unified
School District

K-6, 900 students
Two story, U-shaped brick building with a parking lot and play area -- The Center

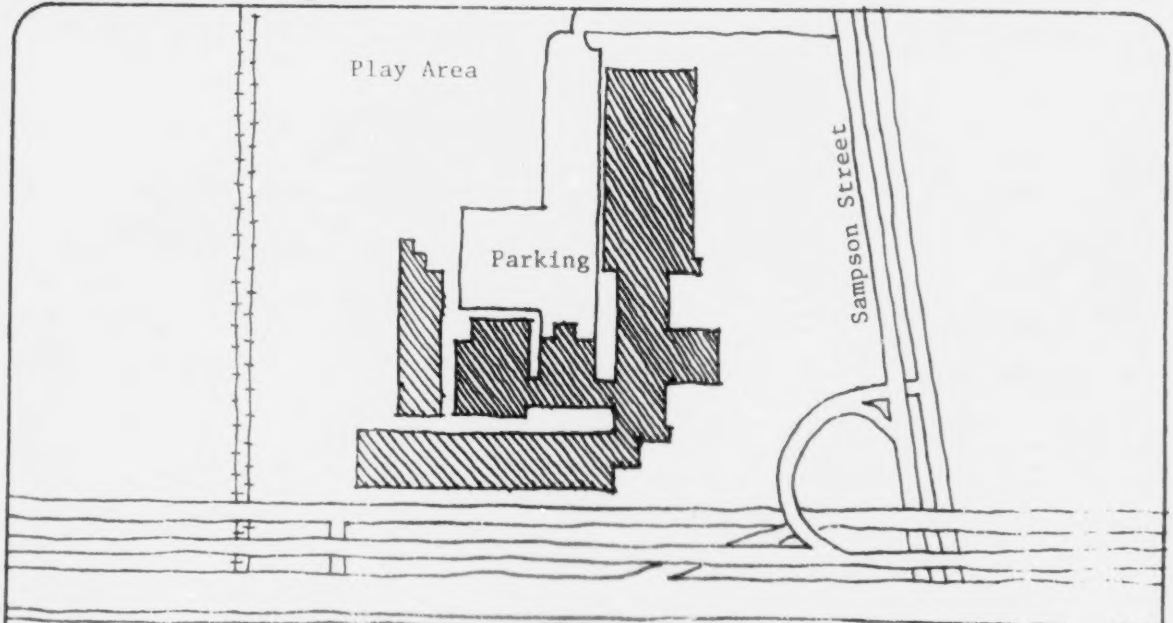
highway

IH-45 Gulf Freeway

6-8 lane interstate freeway with three lane frontage roads on either side.

1948-51 -- Construction completed
1967-present -- Widening of key segments to eight lanes
ADT: 160,000
Straight alignment, approximately 25 feet above grade.

situational diagram



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I. SITUATION CONTEXT -- HISTORY AND CURRENT STATUS

A. Highway

Dodson Elementary School is sixty-five feet from the Gulf Freeway or IH-45, and twenty-five feet from the frontage road. IH-45 was first opened in 1948 and completed in 1951. Since that time, the Texas Highway Department (THD) has continued to improve the freeway by constructing additional lanes, U-turnouts and ramp improvements. In addition, traffic surveillance and ramp metering equipment has been installed. In 1967, the portion of the freeway between Live Oak and Scott Streets was widened to eight lanes. The current expansion provides for the widening of IH-45 and the construction of a portion of State Highway 35 between Live Oak Street and Calhoun Road.

The present maximum daily traffic count for IH-45 at the Dodson School site is 160,000 vehicles and the Texas Highway Department justifies the expansion of the existing roadway on the fact that this daily traffic count exceeds the original highway design capacity of 75,000 vehicles a day. Texas highway planners project that 270,000 vehicles a day will pass the same point by the 1990's and that the IH-45 expansion and the SH-35 addition will be required to carry this sixty-nine percent increase in daily traffic volume.

The existing section of IH-45 between Live Oak and Scott Streets consists of eight lanes with three lane frontage roads on each side. IH-45 is approximately seventeen feet above the school site; the proposed segment of SH-35 will be approximately twenty-five feet above street level. Access with most major streets crossed by the freeway is provided by ramps and frontage roads. Portions to the south of this segment only have three lanes each way and additional highway construction expanding SH-35 (south of Calhoun Street) will increase traffic demand on the Live Oak-Calhoun segment. The Texas Highway Department predicts that failure to widen IH-45 in the affected corridor will result in increased traffic congestion on the freeway and adjacent feeder streets, which will in turn increase air pollution, noise levels and accident risks.

The Live Oak-Calhoun corridor portion of IH-45 and SH-35 are being constructed so that inbound traffic on both highways can merge and outbound traffic may also cross over between the two roadways. This modification will make this segment of the roadway the Central Business District Terminus of both highways and it will function as a feeder system between SH-228, US 59/North/South and IH-45 North.

To reduce the impact of the IH-45 expansion on the neighborhood and to lower land acquisition costs, the Texas Highway Department proposed elevating SH-35 and running the lanes parallel to IH-45 between the roadway and the frontage roads. Other construction work includes:

- Expanding existing medians from four to twenty feet and replacing the steel rail with reinforced concrete safety barriers;
- The addition of twelve foot emergency parking shoulders all along the right-of-way;
- Laying new concrete pavement, and upgrading existing delineations, signs and illumination;
- Relocation and reconstruction of entrance and exit ramps to conform to new Texas ramp design standards;
- Relocation and reconstruction of frontage roads to conform to the above changes;
- Acquisition of additional right-of-way for future improvements and extensions; and
- Widening and updating existing overpasses.

B. School

Dodson Elementary School is located on a 5.8 acre site at the intersection of Sampson Street and IH-45. The brick school is a two story, U-shaped building with a parking lot and a play area in the center of the complex. It was first constructed in 1921 with additions in 1959, 1962 and 1967. Air conditioning was added in 1969. One wing of eleven classrooms was built in 1961 and is the portion of the building that is closest to the freeway -- approximately twenty-five feet from the frontage road.

The facility has fifty-two classrooms with a capacity to serve 1500 students; current enrollment is approximately 900. Ninety percent of these pupils are black. The school's service area is cut in two by the IH-45 freeway system. It is estimated that some 200+ students attend Dodson from the Third Ward residential to the south of the freeway with an estimated forty-five of these subject to relocation because of the acquisition of additional right-of-way for the highway expansion project.

Enrollment in elementary schools in this area is declining generally and has decreased twenty-two percent since 1973 in the school. Approximately 120 students are bussed to the site by a private vendor (the parents pay the cost) using one forty-seat bus and two twelve-seater station wagons. The buses discharge and load at the front of the school on Sampson Street which is off the freeway frontage road. The majority of the children walk to school and those who live south of the freeway usually cross at Roberts Street where crossing guards are located at the points where Roberts intersects the frontage roads. Roughly twenty-five children come to school in their parents' cars, a trend that has been increasing in recent years. These changes in student transportation habits are attributed to increased pedestrian safety risks created by additional traffic in the area, especially on the frontage roads. At one point, residents along the right-of-way sections to be taken in the Third Ward area, south of the freeway, proposed that the right-of-way project be moved northward along the strip of land that Dodson shares with commercial buildings in order to save a large number of residences from acquisition and demolition. This alternative was not adopted by the THD.

C. Proximity Relationships

The area around Dodson is flat with the area adjacent to the school being used for commercial and light industrial purposes. Behind the school and its surrounding buffer of commercial buildings is a mixed neighborhood of light industrial use with scattered pockets of residential housing. South of the freeway is the predominantly residential area called "Third Ward". The majority of the residents of the area are black middle income and working class families. The average family income for this area is substantially lower than the Houston Metropolitan average. Immediately adjacent to the school are a railroad track and Roberts Street which is the major access road to the school for those who live on the other side of the freeway. To the southwest is Scott Street with on and off-ramps for traffic traveling north and south on Scott. Upon the construction of SH-35, two circular off-ramps will connect Scott to SH-35. Two access roads link IH-45 to the frontage road directly in front of Dodson School.

The commercial buildings adjacent to the school generate a moderate amount of truck and other vehicular traffic, increasing the accident risks to students on their way to and from school.

Because of the proximity of the school site to the freeway, it is doubtful that further expansion of the freeway is possible on the northern edge. Further expansion to the south will only eliminate additional housing stock and will encourage commercial development alongside the roadway. The area is already experiencing declining enrollments and the further taking of residential property for public and private purposes will further reduce the population of the area and the number of children of elementary age.

II. IMPACTS

Summary: Impacts on the site include generally the gradual potential erosion of the facility as a quality educational environment suitable for teaching elementary age children. Apparently, vehicular air pollution levels are not as significant a problem as are industrial and downtown generated aerial wastes. The noise level is reduced by the building's central air conditioning system, allowing classrooms to shut their windows during the warm months. No evidence is available to precisely identify the impacts of both air pollution and noise on the children when they are outside in the school grounds. The major concern of the parents and the staff seems to be the pedestrian safety of the children and to this point, the school has initiated efforts to improve student pedestrian safety in the general vicinity of the site.

A. Noise

School staff reports that there is little impact from freeway traffic generated noise on the site now even though the facility is within sixty-five feet of the roadway. Prior to the installation of air conditioning in 1969, teachers complained about the noise but, with the windows shut all the time, noise has ceased to be a major irritant. As one staff member remarked, "There's enough noise to let you know that a freeway is close by, but not enough to distract."

Current noise levels are approximately 65 dBA at a point 300 feet from the center of the roadway, increasing to 75 dBA at the freeway's edge. The proposed expansion will, according to THD projections, increase the road edge noise levels to 80 dBA. While the current noise levels are not a significant impact on the school, one can only question what the impact will be after the expansion increases the system's carrying capacity by sixty-nine percent.

B. Air Pollution

Houston's Annual Air Quality report shows "no signficant deterioration of air quality" in the area. This finding is based on the tabulated readings from six continuous and twenty-two intermittent air quality monitoring stations.

Dodson School is located in the downtown portion of Houston where air pollution levels would normally be higher than residential areas (but lower than industrial sections). Currently, Houston only experiences six stagnant days a year -- usually when a high pressure area shifts the wind to the east and blows industrial aerial pollutants from the Houston Ship Channel over the city. Other studies have shown that the major portion of pollutants in the Houston area are generated by the petrochemical industry rather than auto traffic. Usually, a prevailing southeasterly wind with an average speed of six to twelve miles per hour serves to disperse air-born concentrations of pollutants.

Staff has not complained of air pollution as a problem at the site; however, the school is next to an elevated roadway with the added impact of the proposed elevation of SH-35. Elevated highways create additional problems because vehicle emissions such as carbon monoxide and hydrocarbons flow downhill from the road to the school site. Texas has not built many elevated freeways in the past and the state has had little experience with these types of problems. Consequently, there have been no studies to determine the effects of exhaust emissions from elevated highways on adjacent schools or other institutional sites and little in the way of mitigation measures have been developed or recommended.

C. Loss of School

The decision of the THD to take property on the south side of the freeway resulted in the Third Ward Preservation Council pressuring the highway department to develop alternative routings that would reduce the number of residential units to be purchased and demolished. One proposed alternative was to shift the route northward where most of the property adjacent to the school was inhabited by industrial users. This would have required the relocation of Dodson Elementary School to another site, dislocating additional homes to construct a new classroom facility. The Third Ward Council advocated this as a viable alternative to the loss of residences on the basis that the elementary school adjacent to Dodson had sufficient excess classroom capacity to house the some 900 students who would be displaced. The THD response to this was that:

- Houston Independent School District stated that it did not want to relocate the facility because the buildings were in moderately good repair; and
- If the school were to be rebuilt, other neighborhood residential property would have to be acquired and demolished to construct a replacement facility, thereby dislocating additional families who would not have the relocation assistance and payments available to them under the freeway right-of-way acquisition process.

The school district had originally picked the site because it was central to the service area and district planners felt that the replacement land and construction cost of relocating the school to another site would have been economically out of the question. The only consideration they would have given to closing Dodson would have been if declining enrollments had reached the point where it would be more advantageous to close the facility and reapportion the remaining pupils to surrounding schools.

Although residents and school officials had adequate opportunity to comment on the plan, it appears that there was little balanced and coordinated planning in determining the locations of the IH-45/SH-35 expansion right-of-way. In fact, the highway department appears to have made little deviation from their original route proposal. The result of this was that the real impacts were not anticipated nor were there any attempts to develop mitigation measures in advance of the problem. Many of the mitigation measures and counter-arguments were developed in response to citizens' complaints. The Houston Independent School District feels that THD and school district cooperation and coordination has improved substantially in recent years.

D. Traffic Safety

Traffic safety is a problem to the school staff and the children. The parents worry about what may happen to their children. (The children do not play in the portion of the school yard parallel to the frontage road.) Some concern regarding this issue resulted in the Texas Highway Department agreeing to construct pedestrian overpasses in front of the school. At Roberts Street, directly in front of the school, there are two adult crossing guards and most of the children cross at this location. However, in September 1976, a speeding car ran through a crossing guard's stop warning and struck a student crossing the street, putting him in the hospital. However, this is the only such accident in the last five years.

The lack of fencing on the outer perimeter of the freeway itself is also of some concern to staff and parents. The Texas Highway Department states that fencing the freeway in front of the school is not necessary at this time as the school grounds themselves are fenced. They also comment that there is a "headlight barrier" fence down the median strip on the freeway and that this discourages pedestrians from trying to cross the roadway.

III. MITIGATION MEASURES

Summary: Most of the mitigation measures described below evolved as part of complex interactions of the school staff and parents to the changing environment rather than as the result of a formal assessment or planning process.

The long term relationship of Dodson School and the freeway has made it difficult to view some of the changes that have taken place in the school as direct responses to problems generated by the freeway and its proximity. However, it is clear that the school has responded to changes created by the IH-45 over a long time period. These changes include:

- Crossing guards on Roberts Avenue at both sides of the freeway;
- Parents arranging for private buses to transport those children who do not live more than two miles away from the school site;*
- Construction of pedestrian overpasses in front of the school which are scheduled to be completed at the time the freeway expansion is completed; and
- The installation of central air conditioning in the school. This was not initiated in response to the noise impact, but was done as part of a districtwide air conditioning program. The result, however, was a severe reduction of the noise problem during the warm months.

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*In Texas, only those students who live more than two miles from the school site are eligible for free public transportation.

IV. SUMMARY AND RECOMMENDATIONS

A. Lessons Learned

The long time span of this case is of interest because of the questions it raises. The freeway was first opened in 1948 and a major expansion of the Dodson School was completed in 1949 (an addition of ten classrooms, renovation of existing buildings and the addition of central facilities). In 1951, the freeway was finally opened and in 1957 and 1959, the site was remodeled, a cafeteria was added and sixteen additional classrooms were constructed. In 1962, the district added another fourteen classrooms to Dodson School and in 1967, IH-45 was widened to eight lanes. Finally, in 1969, the centralized air conditioning was installed. During all of this time, there does not seem to be any clear-cut decision by the school district as to what to do about a school whose proximity to a freeway could be a problem. The district continued to upgrade the Dodson School facility with an overall investment of approximately one million dollars and apparently at no time did district personnel question whether the site should be abandoned in favor of redistributing the children to other adjacent school sites less likely to be impacted by future freeway expansions. It would appear that only minimal coordination occurred between the school and the highway department and that both agencies never worked in a concentrated and coordinated manner to attack the problem of highway impacts upon schools.

Residents and school officials were given adequate opportunity to comment on the highway department's proposed expansion. However, there appears to have been little attempt to involve both residents and local school authorities in the dialogue and planning from the initial stages before the highway department became committed to their own rationale for the alternative routings offered. The final route proposed by the highway department deviated little from its original proposal and there seems to have been no real efforts to anticipate problems or to develop mitigation measures in advance. Most of the efforts by THD to address these problems arose as a response to resident concern and agitation.

B. Recommendations

- Where already existing freeways and schools are in close proximity, school districts and highway departments should make clear decisions as to whether the existing and future impacts resulting from increased vehicle volume or expanded capacity will adversely affect the learning environment of that particular school to the point where it would no longer prove to be a suitable facility for teaching the age group it serves. When such a decision is made based on either these projections or current experience, the school district should make a clear decision to phase the facility out and to explore other options for providing classrooms to house the displaced students and this decision should be communicated to highway planners.

- Efforts should be made to involve both residents and school officials in route selection activities prior to the time final routes are identified so that they will have a full opportunity to make input into the route studies.

- Where no previous experience or studies of long term impacts of freeways on schools exist, such longitudinal studies should be undertaken to identify the serious problems and develop substantive mitigation measures to reduce the impact of these conditions upon the learning environment of the facility.

Chronology	IH-45 (Gulf Freeway)
1948	Gulf Freeway opened to traffic.
1965	Construction contract let for widening of lanes between Scott and Delano Streets to provide lane balance for the IH-45, US-59 and SH-288 Inerchange.
1967	Expansion of lanes in the Scott-Delano Streets segment of IH-45 completed.
1968	Studies indicate that traffic volumes have exceeded safe and convenience capacity criteria.
1972	Submission of IH-45 expansion to FHWA. FHWA approves expansion and authorizes Federal funds for project. FHWA approves schematic layout for proposed expansion, including pedestrian overpasses and additional playground area for Dodson School.
1973	Meeting with Houston Independent School District personnel to discuss freeway widening at Dodson School.
1974	FHWA approves Environment Impact Statement for the project.
1979	Proposed contract letting date for Gulf Freeway main lane widening.
1981	Proposed contract letting date for SH-35 elevated section.

case study background data

school

Mt. St. Agnes Center
Baltimore, Maryland
Sisters of Mercy

Formerly a private liberal arts college for women, enrollment approcimately 400, half were residential. Since 1971, buildings under lease for various public and private educational activities, and the property is available for sale.

Construction dates from pre-Civil war to 1962 dormitory. All of masonry and wood frame construction. Library building only is air-conditioned.

The grounds climb steeply from the service road at the southeast corner and Smith Avenue to the west. The dormitory is slightly lower than the other buildings.

The dormitory is approximately 50' higher than the adjacent segment of highway. The center building is approximately 100' higher than the nearest highway segment.

highway

I-83 Jones Fall Expressway

6 lane Interstate expressway with median.

1962-1963: Construction completed.

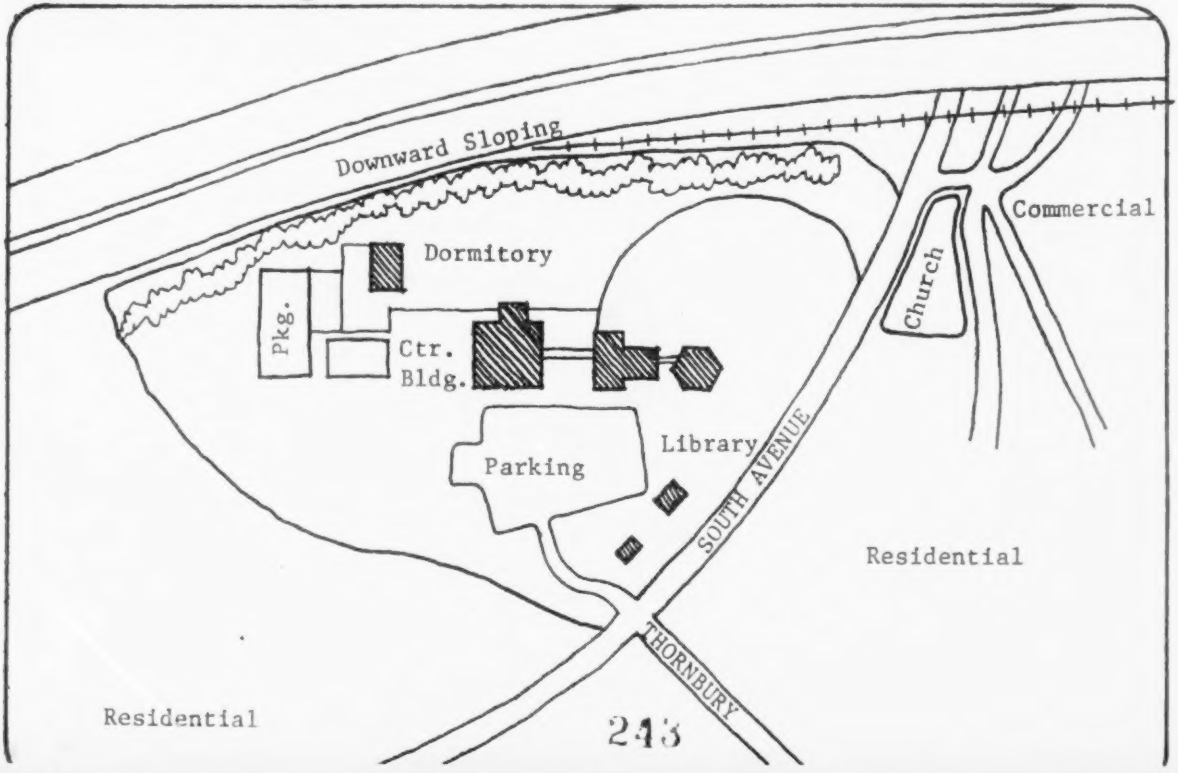
ADT:

Heavy commuter route. No shoulders. Accidents generate long tie-ups. Access is limited and congested.

Slope is downward in the southern direction.

Straight alignment.

situational diagram



I. SITUATIONAL CONTEXT

A. Highway

I-83, or the Jones Falls Expressway, passes along the eastern border of the hilly and wooded campus of Mt. St. Agnes Center. Glimpses of the freeway are possible at points of overlook and gaps in the trees. Along this section, the freeway is six lanes in width with a concrete median strip. The alignment is straight, and there is a moderate downgrade in the southern direction.

The Jones Falls Expressway was proposed by the Baltimore City Planning Commission in the 1940s as an innovative approach to commuter traffic. Not only was the freeway concept itself new, but planners also saw the Jones Falls Expressway as the first radial in an eventual ring and radial design network of highways for the Baltimore Metropolitan region. The alignment was selected in the late 1940s. The City Department of Public works was responsible for its construction. By the time of implementation, the Interstate program had been designated, and federal funds available through the State Roads Commission were utilized to finance some sections. The road was completed and opened in 1962-1963. Jurisdictional responsibility now resides with the Interstate Division of Baltimore City (IDBC), a state/city consortium which performs planning and engineering functions for Interstate routes within Baltimore City. Certain aspects of operations also involve the City's Department of Traffic Safety.

As the first of Baltimore's major freeways, the Jones Fall Expressway embodies many design features which planners later recognized as inadequate. These include interchanges that are too elaborate and poorly located; the absence of shoulders; the design of the median with no potential as a mass transit corridor; the alignment, etc. Although the subject of intensive study, the nature of these problems has precluded significant improvements to the Expressway itself, with the exception of widening of lanes along sections where the right-of-way permitted. Hence, it is liable to severe traffic congestion. It serves as the main commuter route for the northwest suburban area, as well as a major radial feeding into the Baltimore Beltway to the north. Local access from adjacent residential neighborhoods is limited.

B. School

Mt. St. Agnes Center has provided a variety of educational programs since the site and existing buildings were purchased in 1867 by the Sisters of Mercy for Baltimore Province. Mt. St. Agnes College was chartered in 1890. By the 1950s, it had evolved into a four-year liberal arts program for women, with an enrollment of approximately 400, of whom half were residents of the campus. In 1971, the College merged with Loyola College and all college activities were transferred to the Loyola campus. Now the St. Agnes Center site is for sale, and the facilities are leased to various community groups. The Sisters retain space for the Offices of the Administrative staff. Programs operating on campus under lease include a Training and Education Center for the Baltimore City Police Department; a preschool center for emotionally disturbed children, sponsored by the United Fund Agency; and a junior high school class (9th grade) of Region 5 of the Baltimore City Public School system.

The present campus consists of approximately 70 acres on a steeply rising hillside. The original buildings are of pre-Civil War age. Additional buildings were added in the late 1800s, early 1900s, 1925, and 1957. In 1962, a dormitory was constructed at the northeastern corner of the site, closest to the Expressway. All construction is of masonry.

The site rises from a former railroad line to the east, replaced by a service road; and to the west from Smith Avenue, a residential street. One enters the site from Smith Avenue and follows a two-lane private road through lawn and plantings to the roughly level location of the classroom buildings. Beyond the buildings the land continues to rise, and large, private residences occupy the adjacent property. A separate exit road leads back to Smith Avenue.

C. Proximity Relations

At the northeastern edge of the campus, the dormitory building is approximately 500 feet from the Expressway, and relatively 50 feet higher. The Expressway is both audible and visible at this point, through a stand of deciduous trees on the property of Mt. St. Agnes. The Jones Falls Expressway follows a downward sloping grade in a direction south and away from the rest of the campus.

The neighborhood known as Mt. Washington is a well-established residential community. It is located just within the northern boundary of Baltimore City. A town center dominated by antique shops and an old stone tavern is located near the base of the hill on which St. Agnes Center is sited. Two lane residential roads follow irregular routes among the hilly and generously spaced residential lots. Local churches, public buildings, homes, and trees are of notable age and character. Residents are typically professionals with upper-middle income status.

The immediate neighborhood is fully developed. However, the Jones Fall Valley in general is considered one of the major developmental corridors in the metropolitan region. The area still offers the ambience of a country environment and yet is within reasonable commuting distance from downtown Baltimore. Several miles north of Mt. Washington on Smith Avenue, modern, high-rise apartment complexes on either side of the Expressway suddenly dominate the landscape. Much of the area to the north and west is undeveloped; zoning varies from 3.5-5.5 units per acre for the land to the west; to 0.5-1.0 units per acre to the north. Considering just the area from Mt. Washington north to the Beltway (one side of the Expressway), population in 1995 is expected to reach 19,000, an 82 percent rise from 1970. Auto traffic for the same period is projected to increase by 65 percent, from a level of 3,800 peak hour trips to 6,300 peak hour trips.

The nearest interchange for the Center to the Expressway is via Northern Parkway, approximately one-half mile south of the Center. Instructions for automobile access to the site, as printed in the catalog for the former school, direct visitors from all directions to take the Expressway to this exit. However, access from Northern Parkway to the site entrance is awkward, involving travel along four local streets. The present Director advises travelers using the Beltway to exit at the Beltway interchange west of the Expressway, Greenspring Avenue, and cut east on Smith Avenue.

The heavy use of local streets to gain access to the Expressway has been a key concern among Mt. Washington residents. Mt. St. Agnes Center has never figured prominently either in considerations of trip generation or efforts to address the traffic condition. The concern has focused on the traffic patterns of daily commuters. The locations of the existing interchanges, the nature of adjacent development, and the configuration of local streets have combined to create a situation in which residents from throughout an extensive area daily traverse the interior roads of residential developments. In the Mt. Washington neighborhood, average 1970 traffic volume on Smith Avenue was 5,300; and on two older arterials, Greenspring Avenue and Falls Road, 7,000 and 7,600 respectively.

Residents have advocated construction of an additional interchange to relieve commuter traffic through local neighborhoods. Nearly three miles north of the Northern Parkway interchange, the next exit (Ruxton Road) accommodates northbound traffic only, e.g., there is no entry for southbound (Baltimore City) traffic. Four miles north of Northern Parkway is the full interchange with the Baltimore Beltway. Roughly midway between the Beltway and Northern Parkway interchanges is an underpass for Old Pimlico Road. In 1968, residents and the local city Council requested consideration of construction of a full interchange at this intersection. In 1972, the State Highway Administration proposed inclusion of the interchange in its 20-year Highway Needs Study (1973-1992); and prepared a submission to the FHwA for an additional point of access on the Interstate route. In June 1973, the FHwA denied the use of Interstate funds for the construction of the interchange. Under continued pressure from residents, the State Highway Administration stated that its Primary Funds were totally committed through 1979; and questioned whether the proposed interchange would, in fact, provide relief to the Northern Parkway access. In 1974, the Regional Planning Council, responsible for regional comprehensive planning activities, explicitly endorsed construction of a full interchange. A technical analysis was conducted, the findings of which suggested that:

- "Should the Old Pimlico Road Interchange be built --
  - traffic volumes on streets traversing the Mt. Washington area would be stabilized;
  - traffic congestion on the Jones Falls Expressway would be extended somewhat further north in order to allow use of the new interchange;
  - traffic loading on the Jones Falls Expressway at Northern Parkway in the morning peak period would be stabilized.
- Should the Old Pimlico Road Interchange not be built --
  - traffic on streets traversing the Mt. Washington area would probably increase by 60 percent in 1995;
  - the Jones Falls Expressway would still be congested south of Northern Parkway, but would be somewhat less congested north of Northern Parkway;
  - traffic loading on the Jones Falls Expressway at Northern Parkway in the morning peak would increase by 20 percent (by 1995).[1]"

The implications of these findings for the Mt. St. Agnes Center are negligible. Center-related traffic, currently consisting of the police, the public school class (bussed), the preschool class, and a few Center administrative and maintenance personnel, follows the reverse direction of Baltimore City commuter traffic. Hence, it neither suffers nor contributes significantly to the congestion, either on the local streets or on the Expressway. Whether traffic congestion on the Expressway north of the Northern Parkway interchange were to increase as a consequence of the additional interchange, or local street usage increased absent the new interchange, the impact of additional noise and air pollution on the Center is problematical.

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[1] Maryland Department of Transportation and Regional Planning Council, Old Pimlico Road Interchange Planning Analysis, March 26, 1974.

In June 1975, the Maryland Department again submitted a request to the FHwA for point of access approval. The request was denied in October 1975. Reasons given were:

- the existing climbing lanes appeared to conflict with ramp terminals;
- a new interchange would overcrowd the Expressway.

In a letter referencing this decision, the State Highway Commission stated that the apparent rationale for the decision was that the Interstate highway system serves interstate mobility needs, e.g., long distance capacity, rather than the needs of local traffic circulation.

II. IMPACTS -- ON SCHOOL AND HIGHWAY

The major impact experienced by the school was the loss of 29.56 acres purchased for the I-83 right-of-way. Other impacts include the increased, if still awkward, accessibility afforded by the Expressway; and some visual and audial impacts, considered minor by the Director and current tenants. The Director believes that the adjacent location of the highway in no way influenced the closing of the College and merger with Loyola. No impacts of the school on the highway could be identified.

In the spring of 1963, the state filed a case to condemn approximately 30 acres of the Mt. St. Agnes Center site for acquisition as right-of-way. After investigation, it appeared that no offer had been made prior to filing in court; an administrative settlement was pursued thenceforth. There was limited negotiation over the sale price, resulting in a compromise valuation of $1,500 per acre with no severance damage to the remainder of the site. The state's appraisers based their recommendation for the relatively low settlement on the unlikelihood of alternative development or usage by the Center, given the hilly terrain and distance from existing improvements. It was noted that the special purpose use of the site (i.e., a college campus) made valuation difficult. The present Director indicated that the loss of the 30 acres had not proved detrimental in any way to the activities of the Center.

Access to the Center was increased by construction of the Expressway. It facilitated daily travel of commuting students and access to Loyola College and other sites in Baltimore City, as well as the long-distance travel of resident students. However, the overall impact of accessibility on the school, although regarded as positive, was relatively minor. The Director did feel that accessibility to the downtown area contributed to the desirability of the site for the Training Center of the Baltimore City Police Department.

The Director characterized the noise from the Expressway as disruptive to the use of the dormitory, and otherwise a remarkable if inoffensive level in the classroom buildings. The school superintendent stated that the Expressway noise had had no impact on the activities of the 9th grade class. According to the Director, the noise is more noticeable in the winter with the absence of foliage, as is the visual impact, although the latter is rarely more than a glimpse.

The state has neither engaged in nor planned noise impact assessment activities in this area.

In addition to the Center's own fence, the state constructed a chain link fence along the edge of the right-of-way between the service road and the Center's property. There has been some trouble with motorcyclists and truant children using this service road and a small triangle of land located on the other side of the Expressway and acquired in the purchase from the Center. Believing the service road to be within the Center's property line, residents expressed concern about this situation to the Sisters, whose lawyer clarified the ownership and consequent responsibility for maintenance and policing as that of the state. The state has designated the undeveloped triangular property as a scenic overlook.

The Region 5 school superintendent has also disclaimed the presence of the Expressway as a factor in the considerations of the Board of Education regarding possible purchase of the site.

III. MITIGATION -- MEASURES PROPOSED AND IMPLEMENTED

With reference to the impact of diminution of the site by approximately 30 acres, the Center has not found it desirable or necessary to acquire additional acreage. In fact, the site is for sale.

As to the issue of Expressway-associated use of local streets, the Center did not participate in the community efforts to construct an additional interchange. It seems probable that this reflected the Center's relative lack of impact on or by the traffic, as well as a traditional relationship with the community. The Center has been a secluded, self-contained environment, retaining the air of the country lodging school, and not particularly active in the community.

Expressway-related noise, considered a minor impact by the Center, has not been the subject of mitigation proposals, either by the Center or the state.

IV. SUMMARY AND RECOMMENDATIONS

A. Lessons Learned

- The case suggests one lesson with respect to comprehensive land use planning. There is a pattern of isolation of the large and private school from local development activities and plans. Even if present uses of the school site are in fact virtually unrelated to the community, there is a danger that future uses could have significant implications for the community. The site is the only major undeveloped property in the Mt. Washington area. A sale leading to almost any kind of development could result in major transportation impacts; and even alternative uses of the existing facilities could generate additional traffic. Although those involved in the study of the traffic situation, both residents and highway planners, could not have anticipated the sale of the site at inception of interest, the information has been available for several years now.
- The case also provides an example of the typical disruptive impact of noise on residential uses, even though the structure involved here was a dormitory rather than permanent residence.

B. Suggestions

Given the implications of the sale of the Mt. St. Agnes Center site, it is desirable that development planning activities include appraisal of potential usage changes for large, adjacent properties. This involves knowledge of the economic context for existing uses. The private country boarding school could well be a species of land use of tenuous survival, given rising costs of operation and changing demands for educational opportunities. In this case, the residents and local representatives interested in the environmental quality of the community need to recognize and assess the present and potential transportation impacts of all local land uses.

CHRONOLOGY -- MT. ST. AGNES CENTER

1867:	Acquisition of the 107-acre site and existing buildings by the Sisters of Mercy (additional acreage to the west of Smith Avenue was included for a total of 130 acres)
Late 1800s: Early 1900s: 1925 1957	Construction of additional buildings
1940s:	Route alignment selection
1962:	Construction of dormitory building
1962-'63:	Completion of I-83
1963:	Settlement of right-of-way acquisition

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case study background data

school

Del Norte High
5325 Montgomery, N.E.
Albuquerque, New Mexico
Albuquerque Public Schools

Grades 10-12, 2300 students

Constructed 1964. Minor additions: 1967, 1968, 1971, 1974, 1975

Single story concrete block

Windowless, centrally air conditioned

Some portable classrooms

highway

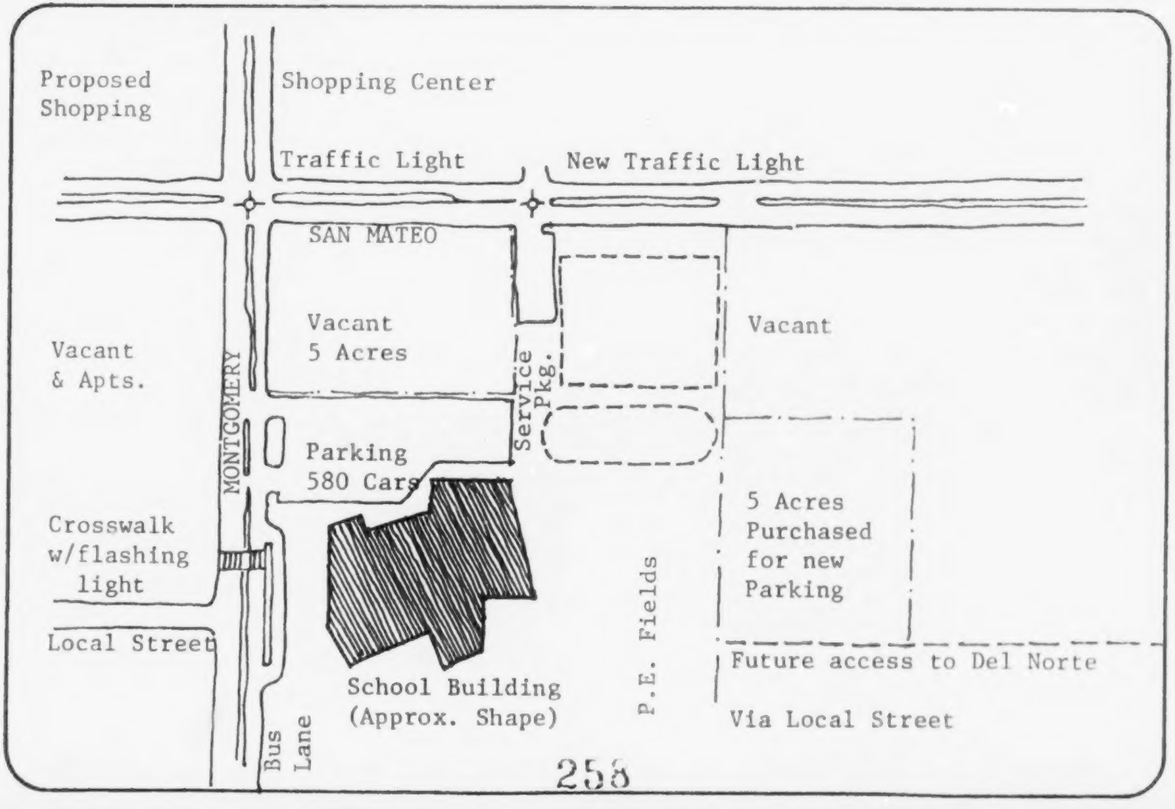
San Mateo and Montgomery Boulevards

6 lane arterials, raised median strip successfully widened from 2 lanes at time of school opening.

ADT: San Mateo 20,000 (1975)
Montgomery 25,200 (1975)

Speeds: 45 mph, heavy east-west rush hour traffic flows.

situational diagram



I. SITUATIONAL CONTEXT

A. Highway

As indicated on the situational diagram, the 35-acre school site has major frontage (1,000 feet) along MOntgomery, a six-lane arterial. This street serves as a major connector between residential development in the still-expanding northeastern Albuquerque area and the major north-south freeway (I-25), approximately one and a half miles to the west. This results in heavy rush hour traffic flows. The 1975 Average Daily Traffic count (ADT) of 25,000 is among the higher in the City and is expected to continue to grow at a rate which is greater than average. Average daily traffic has increased 580% in the past ten years and almost 50% during the past five years. Montgomery was successively widened from 2 lanes when the school opened in 1964, to 4 lanes, and then, approximately five years ago, to six lanes. The street was widened from the outside in, i.e., the outer lanes in each direction with their associated curbs and gutters were improved first. Subsequent widenings were taken from the median strip. The right of way was originally designated for expressway improvements. The parcel at the northeast corner of the San Mateo-Montgomery intersection was formerly owned by the City. It was later sold in order to acquire land in an area of urban expansion. Some land was retained along both streets to provide for future improvements.

San Mateo has always been a major north-south arterial. It is presently six lanes and carries an ADT somewhat lower than Montgomery's (22,000), and one which is not expected to increase as rapidly. The average daily traffic on San Mateo has increased 87% in the past ten years and almost 50% during the past five years.

Both streets have 45 mile per hour speed limits. Both are straight, almost flat and are only slightly lower than the grade of the school site.

There are cuts in the center median strips of both Montgomery and San Mateo for use in left turns onto and off of the school site. The center medians are raised to curb heights and are approximately 8 feet wide.

There is a school crosswalk on Montgomery with a flashing warning light approximately 1,000 feet from the main intersection. A traffic light has just been installed on San Mateo approximately 600 feet north of the intersection. This is intended primarily to serve shopping center traffic although it will also be of some benefit to the school.

Administratively, San Mateo is a Federal-aid Primary Extension and Montgomery is a Federal-aid Urban facility, both of which are under the jurisdiction of the New Mexico State Highway Department. Transportation improvements for the Albuquerque Urbanized area are contained in the annual element of the Transportation Improvement Program. This program is developed annually and adopted by the Urban Transportation Planning Policy Board of the Middle Rio Grande Council of Governments the A-95 review agency. Board members include representatives of county governments, the Albuquerque Public Schools, and advisors from all agencies concerned with transportation planning.

B. School

Del Norte High School originally served 10 through 12. In 1977 it will be expanded by 600 students to serve grade 9. Current enrollment is approximately 2,300. The building is windowless and air conditioned. It was built at one time and opened in 1964. The site was identified in a 1960 land use plan for a 1980 planning horizon. Subsequent additions have been in the form of modular portable classrooms.

Part of the building, which includes a home economics day care nursery, is within 50 feet of the edge of the pavement of Montgomery. The rest of the building is approximately 300 feet from that street, set back behind a parking lot with a capacity of approximately 650 cars, used by both students and staff.

The school serves an area within a radius of approximately two miles. There is minor busing--five buses per day--of students who live beyond two miles. Almost all students come from the assigned attendance area; there is no program for open enrollment. The distribution of students living to the south and north of Montgomery is now almost equal. There was originally a preponderance of pupils living to the south, but this has balanced out as residential development has shifted to the north. The area has experienced significant continuing growth in residential development.

The school is used in the evenings and weekends for a variety of purposes and this is encouraged by the community facility use policy of the School District.

C. Proximity Relationships

Both major streets within a several mile radius of the school site are characterized by a combination of strip commercial, shopping center and apartment project development. These are the primary causes of the relatively heavy daytime--as opposed to rush hour--traffic flows. Residential development to the north and east is the source of the heavy rush hour traffic.

The topography in the area is relatively flat and has no bearing on the proximity impacts.

Major vehicular access to the school site is via Montgomery. This leads to the main parking lot. The school has staff parking for approximately 80 cars and student parking for around 500. In 1975 approximately 900 student parking permits were issued. Students also park on vacant land behind the school off of San Mateo, and across from the school on Montgomery.

During morning peak commute time cars turning into the school from Montgomery, both east and west bound, cause considerable congestion.

There is a traffic light at the intersection of Montgomery and San Mateo and one approximately 600 feet north of the intersection which serves shopping center traffic. There is a marked crosswalk with flashing yellow light on Montgomery approximately 1,000 feet east of the intersection. The speed limit is 45 miles per hour, there is no school-related reduced speed zone.

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II. IMPACTS

A. On School

Pedestrian safety problems were mentioned by all respondents. These have grown with increasing traffic flows on Montgomery. Everyone cited the dangers of crossing a six-lane arterial with relatively high speed traffic, particularly during the morning rush hour. There is a city ordinance requiring traffic to stop for pedestrians in crosswalks, but the other two lanes of traffic do not necessarily stop for pedestrians, even when one lane has stopped. The center median strip does provide a convenient safe zone.

Pedestrian crossing behavior was measured by the City Traffic Engineer in 1974 at the request of the school student government after a student was struck by a car and seriously injured. Of approximately 350 students observed crossing Montgomery during a morning rush hour, only 150 used the designated crosswalk.

Automobile access problems were also mentioned by all respondents. School-related respondents emphasized the difficulties of coming into, or out of, the main parking lot. This was seen as directly related to the heavy traffic, the absence of a control device and the risks of being struck by through-traffic because the left turn lane on Montgomery east bound does not have adequate capacity and there is no exclusive curb-side right hand west bound deceleration lane.

Leaving the school site, the problems were seen by these respondents as those of inconvenience as well as danger because of the indeterminately long waiting periods before a break in the traffic allow one to drive onto either arterial.

School-related respondents also mentioned several site-specific problems which contribute to this hazard. Many parents stop to drop off students at the curb side on Montgomery in an area where there are no stopping restrictions. The separate drop-off lane in front of the school is small and often occupied by school buses. Another source of vehicle access hazards is the failure of some drivers to observe the designated one way entrance and exit patterns. This has led to accidents because the fence at the school property line along Montgomery obscures entering driver's vision of cars which are exiting from the designated entrance.

Less major, but still negative impacts reported by school-related respondents included:

Noise: Although the building is intended to be centrally air-conditioned and does not have windows, many classrooms have exterior doors which teachers regularly open during hot weather because of inadequacies in the ventilation system. There are continual complaints about noise from the street interfering with instruction, but, surprisingly, no complaints about the ventilation system itself.

Air Pollution: This was reviewed by a consumer chemistry class and found to be quite high. It was mentioned that this area of Albuquerque experiences high pollution levels in the winter and therefore there is no evidence that this is a site-specific problem.

The proximity of the site to both major arterials was not perceived as providing any particular advantages for the use of school facilities after school hours. If so, the advantages of convenient location were generally seen as far outweighed by the disadvantages of dangerous access.

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Summary

It appears that the rapid increase in traffic on Montgomery was probably unanticipated or not considered when the school site was chosen. This also applies to the high rates of car usage by students. An example of the growth of sources of traffic generation in the area is the fact that 7,000-9,000 new apartments have been built along Montgomery within the past five years, as well as several shopping plazas.

There is some difference of opinion concerning the possible benefits of the location of the school near commercial development with its related traffic generation, and also with respect to the geographical distribution of the other high schools, but everyone agrees that the site is inappropriate because of present traffic conditions.

There is also agreement that the placement of activities on the site was poorly planned in relation to both internal traffic circulation and the presence of the two major streets.

B. On Highways

The major negative impacts of the school on the arterials were perceived by all respondents to be related to the hazards and congestion to through traffic, particularly on Montgomery, caused by school-related pedestrian and vehicular activity. School-related respondents perceived these impacts as negative during the morning rush hour which coincides with school starting time, but only somewhat negative during the afternoon when school activity does not coincide with commuter peak traffic. Highway-related respondents considered the school's impacts very negative in the morning and still quite negative in the afternoons.

All respondents showed the opinion (unconfirmed) that there is almost one vehicle accident per month during school. A check of accident data for the Montgomery/San Mateo intersection during October 1975 to September 1976, indicates that there were 52 incidents, none of which involved pedestrians. Thirteen involved rear-end collisions related to private driveways, and a total of 28 were not related to the intersection itself. It is not clear which, if any, of these were related to the school. Disruption to traffic flow is seen to be due to the students crossing the streets in a random pattern rather than at the crosswalk and to the slowing and stopping necessary in order to turn to enter the school parking lot. Parents stopping to pick up or drop off students in the curb lanes which is meant for normal traffic circulation is also seen as a major negative impact of the school on the streets, particularly to the traffic engineers.

III. MITIGATION

A. Measures Proposed

All the mitigation measures which have been proposed and those which have eventually been implemented, have been in response to the functional problems associated with the specific Del Norte situation. There are no legal mandates in New Mexico related to the mitigation of traffic or pedestrian safety (or noise or other impacts for that matter) associated with high schools. There are requirements for measures to be taken to assure crossing safety at elementary schools.

From the time that Montgomery was widened to four lanes, there have been mitigation measures proposed for various safety hazards by those associated with the school. These have included:

- Installation of a bus lane for drop-off and pick-up.
- Establishment of a marked crosswalk on Montgomery.
- Installation of a traffic light to control traffic associated with both the crosswalk and the main vehicle entrance to the site.
- School purchase of the vacant parcel at the Corner of Montgomery and San Mateo to be used to rearrange vehicle access to the site and the on-site parking and internal circulation.
- Installation of a pedestrian overpass in place of the crosswalk at Montgomery.
- Installation of positive one-way control devices at the entrance and exit at the school parking lot and Montgomery.
- Establishment of a school speed zone in the vicinity on Montgomery.
- Provision of cuts in the center median strip for left turns from Montgomery and San Mateo onto the school site.
- The local Council of Governments has mentioned that a number of other approaches have not been considered, but perhaps should be, including reduced student parking permits, driver education, a closed campus, revised operational hours, further curb-side improvements and increased busing.

B. Measures Implemented

A number of proposed measures have been implemented by the school itself or by the school district, or in some cases by others using school funds. These include:

- Construction of school bus turn-out. This work was performed and paid for by the school district in order to alleviate problems associated with the original school site plan.
- Creation of left turn bays in median strips of San Mateo and Montgomery. This was requested by the school district after the widening of Montgomery to six lanes. The work was performed by the traffic department at a cost to the school district of approximately $2,500 for each of two bays. Lack of coordination between the City and the school district appears to be the reason these turn bays were not provided with the street was widened.
- Designation of one-way circulation at the main school parking lot on Montgomery. This has not proven completely effective even with enforcement by school students and staff. The school is now considering the installation of positive one-way control devices.
- Purchase of additional land for use to provide additional student parking and an alternative means of access to the school site. The school district has recently purchased five acres at the rear of the school site which will be used as the new location for student parking. This will then be given access to San Mateo via a local street and is expected to substantially reduce congestion and vehicle safety problems on Montgomery. There are plans to allow only staff parking in the front lot and to use the excess space for additional buildings and an extended school bus and parent drop-off lane. The impetus for these changes was primarily the school district decision to expand the use of the school site and add approximately 600 ninth grade students.
- In addition, the traffic department installed a flashing light at the crosswalk on Montgomery. The school district and school parents had often requested that the City Traffic Department install a stop light. After investigation, the traffic department determined that the then-existing traffic counts and vehicle movements into the school, in addition to the relatively close proximity to the intersection of Montgomery and San Mateo (± 1,000 feet) precluded the installation of a traffic light.

  Under New Mexico state law, the traffic department is not permitted to install traffic lights without substantiating the need for the device. On the basis of the pedestrian movement survey, the traffic department anticipated that a signal's purpose would be defeated because pedestrians would cross anywhere and not use the signal location.

The traffic department determined that a flashing light was the appropriate device and paid for its installation and continued operation and maintenance.

The traffic department recently conducted a series of radar speed measurements to determine the effectiveness in slowing traffic of the flashing light associated with the pedestrian crosswalk on Montgomery. The results below are the 85 percentile speeds.

Flasher Off (no students present)	42 MPH
Flasher On (no students present)	36 MPH
Flasher On (with students present)	34 MPH

The study was made for use in planning traffic control in the area of a new high school at another location.

Two other mitigation measures, long requested by the school, the designation of a reduced speed-zone in the area of the school on Montgomery and the construction of a pedestrian overpass, have not been implemented.

The traffic department determined that a reduced speed zone would cause excessive congestion during peak traffic hours, particularly as there is a fifteen mile per hour school zone in the vicinity of an elementary school approximately one half mile east of Del Norte.

It was only after the requests for a stop light and a reduced speed zone in front of the school had been rejected by the City Traffic Department that parents and school staff proposed the construction of a pedestrian overcrossing. These respondents mentioned the difficulty of identifying the agency(ies) to which they could carry requests for the construction of a pedestrian overpass. Their desire for the overpass was heightened by the suggestion that an existing overcrossing at another school which had closed was no longer in use and could perhaps be moved. Estimates for the cost of this operation ranged from $10,000 to $100,000, although it is not clear where these originated. The present estimate is $100,000, including engineering. The school parents advisory group initiated the request and worked to coordinate the efforts of the school principal (presently a city council member), the City Traffic Department, the State Highway Department and the local Council of Governments. Although the first (1972-'73) Transportation Improvements Program Plan for the Albuquerque urban area included an item for pedestrian bridges at public schools, it does not appear that one at Del Norte was included at that time.

The parents group discovered after a time that the Council of Governments (COG), as the local A-95 review agency, appeared to be the key to the commitment of funds. Working with the support of the school district director of building planning, who is also a member of the COG Transportation Coordinating Council, they succeeded in having the overpass added to the capital improvements priority list in 1975. It is now included on the 1976 Annual Element of the Transportation Improvement Element; preliminary engineering has been completed and it is scheduled to be paid for on the basis of almost 80 percent federal funds and 20 percent from the school district. It is the responsibility of the school district to initiate the project and this has not been done yet.

Several respondents questioned the real effectiveness of a pedestrian overcrossing in preventing students for continuing to run across Montgomery unless both sides of the street were also fenced off. They also felt that the nearby elementary school was a more appropriate location as it would be easier to encourage younger children to use the overpass.

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IV. SUMMARY AND RECOMMENDATIONS

A. Lessons Learned

All the respondents felt that in one way or the other, a lack of communication and consultation between concerned parties was responsible for many of the past and present mutually negative impacts between the school and the arterials.

There was a feeling that the school was inappropriately sited near the intersection of the two major arterials. This was due to the lack of consultation between the school district and the City traffic and planning departments at the time the site was chosen. It may well have been common knowledge in the city departments that traffic on Montgomery, in particular, was projected to experience rapid growth. It is difficult to believe that the school district would have chosen the site in the light of such priorities.

In addition, it is clear that the school site and internal vehicle circulation were inadequately planned in relation to major street circulation patterns. Placing the majority of parking directly on Montgomery was, with the benefit of hindsight, a bad decision. The traffic department feels that it should be involved in the site-planning process from the beginning, not after bad planning has generated problems. In recent years it has become more involved through sign-off requirements under the use-permit award process, but it still is not required to review school site plans.

There continue to be expressions of concern over the lack of personal commitment between the actors involved in the school and traffic planning process. Those involved with the school itself are also concerned over the lack of commitment on the part of either school district or the city and state traffic planners to consult with them.

There was a general feeling that all concerned have an increasing awareness of the needs and involvements of the other parties. There was no indication that these parties did, in fact, voluntarily consult with each other. It appeared that contacts between school and highway traffic planners were typically only made at the instigation of the school users, and this was always to correct problem situations that might not have occurred if this contact had been concurrent with the planning for the original physical improvements. The process has been improved as the director of building planning for the school role is a member of the COG Transportation Coordinating Council staff task force. There remains a tendency for the school district to act unilaterally with respect to planning for school service extensions because of the independence of its taxing powers and revenue source for capital improvements.

B. Suggestions

Given that all respondents considered poor communication to be the root cause of all the functional problems related to Del Norte and the major arterials, all agreed that legal mandates were not a desirable way to improve the planning and coordination process, although the COG feels that these requirements may be necessary to assure coordination. All respondents felt that awareness on the part of the major actors and a personal commitment to good planning was the best possible future solution to the problems.

In spite of these expressed aspirations, and the feeling that mutual awareness was growing, there were no indications that voluntary communication had improved. Typically, the negative impact identification and mitigation planning process continues to be initiated by those affected, usually school users. Although the users claimed to have a very difficult time securing responses from facilities planners within the school district and related to city traffic facilities, it is clear that district and agency planners are apprehensive of legal requirements for formal coordination because of fears of the time-consumption and frustrations associated with additional bureaucratic reporting requirements.

As long as school district funding, particularly for capital improvements, comes through an independent taxing power which is local in nature, and therefore not subject to the coordination imposed by A-95 review, there will be a tendency, as stated above, for the district not to feel committed to extensive formal planning and coordination before selecting school sites. Other agencies, particularly the State Highway Department, will also tend to want to have their plans for major improvements considered as foregone conclusions requiring the accommodation in planning by those remaining agencies and interest groups that were not fortunate enough to 'get there first.' This may be changing as there are broader federal regulations to induce more integrated planning in the development of local priorities for improvements as coordinated by the local Council of Governments.

In the absence of new state or federal requirements for the formal coordination of all school facilities improvements with the transportation and traffic control projects presently subject to A-95 review, school parent groups appear to be the most effective source of demands for planning coordination and negative impact mitigation. This is because parents are voters and therefore constituents to those policy makers on the school boards and city and county governments most responsible for implementation.

One implication of the potential effectiveness of those parent groups is that longer membership and better organization will lead to higher visibility and greater effectiveness, particularly with respect to mitigation of existing school-highway problem situations.

Another implication is that these parent groups should gain access to the workings of the Council of Governments, not only through the public hearings at which the transportation capital improvements priority list is presented to the city-county land use planning commission each year for their comments before submission for approval by the COG elected officials policy board, but also by maintaining liaison with the COG planning staff. This is best accomplished through a series of ongoing informal workshops with citizens, including those representing school parents' interests.

It appears that some forms of increased personal commitments to coordinated planning will be the most effectivemeans for preventing problem situations requiring extensive mitigation measures after the fact.

CHRONOLOGY -- DEL NORTE HIGH

Until 1950s	San Mateo main approach road to city from north. Montgomery unpaved 2 lane street in right-of-way sized for eventual 6-lane expressway. City owned adequate land at intersection for eventual construction of grade separated interchange. At time school site was north of existing urban development.
Late 1950s	School site selected for reasons which are unclear. Site is somewhat too close to existing high school. Two lanes of Montgomery are paved. These are the outermost lanes which along with the gutters and curbs permanently define outer edge of roadway. Later widenings occur in center median area.
September 1964	School occupied by 1,600 pupils. Surrounding area still relatively undeveloped. Sometime during this period the plan for the eventual development of Montgomery is modified from a restricted access expressway to an unlimited access major arterial in response to pressures from businesses with roadside properties.
Mid-1960s	Montgomery widened to 4 lanes as rapid residential and commercial growth begins in areas surrounding the school.
1971	Montgomery widened to 6 lanes. Traffic volumes increasing rapidly. School constructs bus pick-up lane.
Early 1970s	Growing concern with pedestrian and vehicular safety problems related particularly to traffic on Montgomery leads to a number of mitigation measures. A crosswalk is painted on Montgomery, a flashing light is installed, breaks are created in the median strip for left turns between Montgomery and the school site. Parent Advisory Group (PAG) begins to request further public agency-provided safety measures.
1972	Pedestrian bridges for public schools included in first Albuquerque Transportation Improvement Program Plan.
1974	Serious vehicle/pedestrian accident leads to student body request to City Traffic Engineer for safety studies. Traffic Engineer does not agree that situation is appropriate for, or warrants, either a reduced speed school zone or a traffic signal at the existing crosswalk.
1975	PAG secures placement of budget item for pedestrian overpass on the middle Rio Grande Council of Government's (COG) highway capital improvements priority list. School District purchases an additional five acres at back of site for shift of student parking and the creation of an alternate means of student vehicle access.

PERSONS CONTACTED: DEL NORTE HIGH

Jon C. DuFresne
Assistant Traffic Engineer
City of Albuquerque Traffic and Transportation Department
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Albuquerque, New Mexico 87103

Directly responsible for planning and implementation of traffic improvements
Interviewed

Donald Hayes
Director of Planning
New Mexico State Highway Department
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Telephone contact concerning state role and legislation

Thomas Kennedy
Signal Systems Engineer
City of Albuquerque Traffic and Transportation Department

Responsible for traffic volume and speed measurements and pedestrian activity monitoring
Interviewed

William McMillan
Director of Building Planning
Albuquerque Public Schools
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Albuquerque, New Mexico 87125

Responsible for all phases of schools facilities planning
Interviewed

Prince Pierce
Past President, Del Norte School Parents Advisory Group
2909 Florida N.E.
Albuquerque, New Mexico 87110

Head of Parents Advisory Group Committee on Pedestrian Safety
Interviewed

La Roma Thompson
Assistant Principal
Del Norte High School
5323 Montgomery, N.E.
Albuquerque, New Mexico 87109

Interviewed

James Minton, Transportation Planner
Walter Nickerson, Chief Engineer
Middle Rio Grande Council of Governments
505 Marquette, N.W.
Albuquerque, New Mexico 87102

case study background data

school

Hixson Junior High
Goodall Elementary School

Webster Groves Public Schools
16 Selma Avenue
Webster Groves, Missouri 63119

Hixson Junior High School
7-9, 650 students
Single and two-story brick and frame
Constructed in 1956
Adjacent to city park and recreation complex

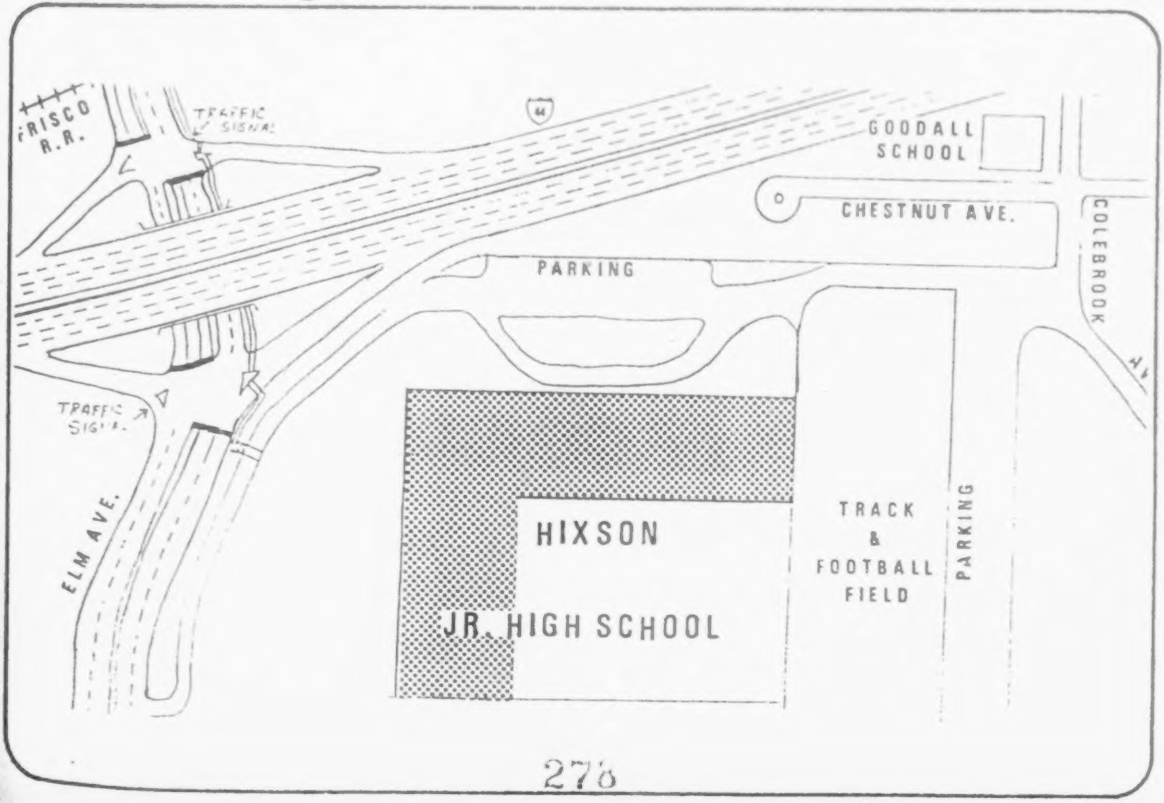
Goodall Elementary School
K-6, 280 students
Two-story brick
Single story frame addition
School built in 1908
Cloded in June 1975
Playground abutts freeway ROW

highway

Interstate 44

I-44 built in 1965-1967
8-lane freeway elevated 20 feet at school site
Require relocation of Elm Avenue for full diamond interchange
ADT: 60,000 (1976)

situational diagram



I. SITUATIONAL CONTEXT

A. Highway

In the mid-1950s a need was expressed for a freeway to serve the southwest corridor and to replace existing U.S. Route 66 in the St. Louis metropolitan area. At that time, this potential freeway was placed on the metropolitan freeway system for planning purposes. For the next five years, alternative routes were examined and some preliminary designs prepared. With all the possible alternatives, a total of approximately 20 different routes could be found for the 11 miles of the freeway. Although there were numerous alternative routes, in the area of the study site only one route was seriously considered due to the St. Louis and San Francisco (Frisco) Railroad which already cut through the area. The Highway Department felt that a freeway route paralleling the Frisco would be the least detrimental to the area.

By the early 1960s, the various alternatives had been reduced to two or three major route locations with short section alternatives. The Highway Department held a public hearing in the Kiel Auditorium in downtown St. Louis fo- the entire 11-mile route. This auditorium holds approximately 4,000 persons and was practically full for the hearing. The hearing resulted in the selection of the present route and detailed design commenced.

Numerous citizen groups organized and some became vehemently opposed to the new freeway. Those in Webster Groves felt the road would cut the community into two parts and that traffic on local streets would increase at the interchange points. None of these groups, however, used the schools as a focal point for their opposition to the freeway.

Rather detailed discussion between the Highway Department and the School District took place prior to contract letting. These discussions dealt with the detailed design of the I-44/Elm Avenue interchange and the concerns of the District over student access along Elm Avenue and to the north of I-44.

In 1967, the freeway was open to traffic past the study site.

B. School

1. Hixon Junior High School was constructed in 1956 and is operated by the Webster Groves School District. It provides education for 650 students in grades 7, 8, and 9. The building is two levels with one level partially below ground and constructed of brick and concrete. It is adjacent to the park and recreation complex of the City of Webster Groves.

   Students come to school by walking, as passengers in a car, and by bus. By state law, those students living more than one mile from the school and any student who must cross a "hazardous route," as defined by the District, must be bused to the school.

   The school draws its students from the City of Webster Groves and some other smaller St. Louis suburbs. A broad range of socio-economic levels are represented by the students. However, since the majority of homes in Webster Groves are in the $50,000 to $100,000 price range, the higher levels are more predominant.

2. Goodall Elementary School was built in 1908 and an auxiliary classroom building was added in the late 1950s to handle increased

enrollment. The school provided education to approximately 280 students in grades K through 6. The building is a three-level bri k with one level below ground. A small playfield for students is adjacent to the west side of the building.

Before I-44 was constructed, the school was approximately in the center of its attendance area. After the freeway was built, the boundaries changed to reflect the geographic restriction caused by the new road. The socioeconomic makeup of the students and their families did not materially change when the attendance boundaries changed.

C. Proximity Relationships

1. Hixon Junior High. The terrain of the area is gently rolling with the freeway being built on cut and fill to reduce the constant grade change. The land use in the area is mainly residential with recreational and park use being immediately south of the school site and some neighborhood commercial uses existing along Elm Avenue north of I-44.

   The school is approximately 20 to 25 feet below the grade of I-44. The northwest corner of the school property abuts the eastbound on-ramps of the freeway. School buildings are within 400-500 feet of the freeway.

2. Goodall Elementary School. The terrain of the area is gently rolling with the freeway being almost at the same grade as the schole where the property abuts, but the freeway being almost 25 feet above grade on fill at the Elm Avenue interchange immediately west of this site.

Land use in the area is almost exclusively residential except for a market in a converted house in the southeast corner of Colebrook and Chestnut Avenues.

The north end of the school property abuts the freeway. School buildings are approximately 150-200 feet from the freeway.

II. IMPACTS

Since both schools were built prior to the freeway, there were some impacts on them resulting from I-44. Discussions with School District personnel indicated the following impacts.

- Elm Avenue had to be relocated west to avoid Hixon Junior High. The original plans would have placed Elm Avenue within 50 feet of the school building.

- An existing underpass at Maple Avenue and the Frisco Railroad was closed. This underpass was directly across the railroad from Colebrook Drive and was used by students from both Hixon and Goodall Schools. Some discussion took place relative to extending this access facility under I-44, but the Highway Department prevailed and stated that the underpass would be costly and a duplication of the access at Elm Avenue. The School District did not press the issue.

- The parking lot and main access road to Hixson was severed and relocated. The parking lot was reduced by one-half and those spaces were moved to the east side of the building. This necessitates longer walks by staff and school visitors.

- Attendance boundaries for the district changed due to I-44. This was a problem but did not cause the type of negative reaction that might be expected in some school districts.

- Possibly the major impact was the loss of taxable real estate to the freeway. The assessed valuation in the district dropped by over $1,000,000 and, consequently, district income dropped by about $50,000. No tax increase was instituted in the district because a revision in the state's school aid formula made up the revenue loss. This state aid formula revision, however, had nothing to do with I-44.

- The Goodall School closed in 1975. The closing was due mainly to dropping enrollment. School district officials do not blame I-44 exclusively for the closing, but do feel that the freeway hastened the closing through the elimination of approximately 100 homes and 130 students. Changing family size is, at the least, equally the reason for the closing.

- No noise problems were noted by school officials.

III. MITIGATIONS

During the planning and design stages of the freeway, numerous meetings were held between the Highway Department and School District personnel. The principal purpose of these meetings was the design and location of the Elm Avenue underpass. The original plans would have placed Elm Avenue within 50 feet of Hixson School. At least a dozen different designs were reviewed by the School District before a final one was accepted.

This change was made because of the concern of the district about the road being so close to the school. The concern was for pupil safety and the noise from the new street. The final plan placed Elm Avenue between 200 and 400 feet from the school. This distance appears to have satisfied the district since no complaints of noise were noted.

Other minor mitigation which took place during the planning and design stage of I-44 related to the closing of the Maple Avenue underpass. While the district would have liked to keep this open, they did not take extraordinary steps to do so. It, evidently, was not as important as the moving of Elm Avenue south to avoid Hixson.

No other mitigation took place that was directly related to the schools.

IV. SUMMARY AND RECOMMENDATIONS

A. Lessons Learned

The Highway Department was as responsive to the situation as required for the time period.

The School District was able to alter the design and location of the Elm Avenue underpass to minimize its impact on Hixson Junior High.

The freeway construction probably hastened the closing of Goodall School by reducing the student population through demolition and elimination of homes.

School districts lose income as a direct result of a freeway's construction due to the loss of homes and, therefore, the loss of assessed valuation in the district.

B. Suggestions

The financial impact of freeway construction on school districts must be determined. This impact should take into account the tax base loss and the resultant monetary loss to the district. This loss must be calculated over time and some adjustment should be made to the district. Perhaps Type 2 Project funds are available for this purpose.

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CHRONOLOGY -- HIXSON JUNIOR HIGH AND GOODALL ELEMENTARY SCHOOLS

1955	I-44 placed on metropolitan freeway system for planning purposes.
1960	Initial location and design plans completed.
1960-1962	Discussions between Highway Department and School District over geometrics and access at Elm Avenue.
1962	Public hearing held to determine actual route of freeway for 11 miles from I-270 on the west to I-55 on the east in the City of St. Louis.
1964	Final plans completed and construction begun.
1967	Freeway opened to traffic past study site.
1975	Goodall School is closed.
1977	A part of Goodall School is leased to Webster College for academic programs.

PERSONS CONTACTED: HIXSON JUNIOR HIGH AND GOODALL ELEMENTARY SCHOOLS

Mr. Charles Garner, Assistant Superintendent, Retired
Mr. Donald Morrison, Director of Elementary Education
Webster Groves Public Schools
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Webster Groves, Missouri 63119

Mr. Donald Garrett, District Survey's & Plans Engineer
Mr. Eugene Borgschulte, District Chief Designer
Missouri State Highway Department
District 6
321 South Kirkwood Road
Kirkwood, Missouri 63121

case study background data

school

Visitation Academy
3020 Ballas Road
St. Louis, Missouri 63131
Order of the Visitation

Private, Catholic all girls

Grades 4-12, 500 students

Single-story brick
School built 1961, expanded 1967
Building includes cloister for nuns

highway

U.S. Route 40, Ballas Road

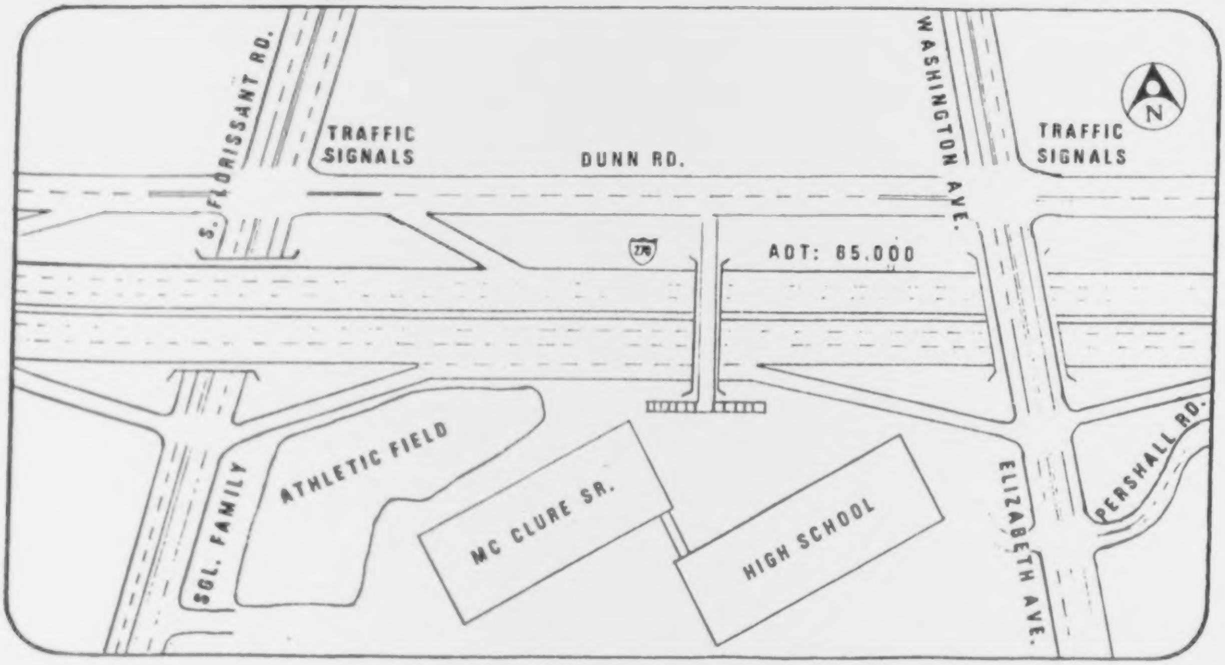
Built in late 1930's, widened 1974
Ramp rebuilt in 1966

6-lane freeway, partially elevated.
Ramp at-grade with school.

ADT: 12,000 (1976)

Speed Limit: 35 m.p.h.

situational diagram



I. SITUATIONAL CONTEXT

A. Highway

The present U.S. 40 was built prior to World War II as a Work Progress Administration (WPA) Project from the Missouri River on the west to Lindbergh Boulevard approximately 2½ miles to the east of the study site. The road, at that time, included two, two-lane roadways, each 20 feet wide with a lip or roll-over curb and a grass median of approximately 30 feet.

In the late 1940's, a Master Plan for Freeways in the St. Louis area was completed. This plan indicated the need for the extension of U.S. 40 to the east of Lindbergh Boulevard into the CBD of St. Louis. Included in this was the possible need for widening of U.S. 40 to accommodate increased traffic volumes.

In the mid-1950's, the need for a belt freeway around St. Louis was determined and this freeway was incorporated into the overall Freeway Master Plan. At that time, location studies were taking place and some preliminary design was done to the detail of determining that the ramping at U.S. 40 and Ballas Road would require changing to a folded diamond interchange with all ramps on the east side of Ballas Road.

In the early 1950's, a gasoline tax increase was passed in the state. In order for this tax to pass the state legislature, the Highway Department agreed to take over all the then existing county-maintained roadways. This addition, to the system resulted in the state being incharge of 32,500 miles of roadways. This total mileage ranks approximately 4th or 5th in the nation. Because of this large mileage, the Highway

Department is extremely money-conscious in terms of using their funds for maintenance and rebuilding all road facilities.

During the early 1960's, the Highway Department had discussions and negotiations with the school owners and property owners along the south side of U.S. 40 between Ballas and Spoede Roads. (Spoede Road is the next interchange to the east, approximately 1.75 miles.) This discussion led to the elimination of that service road because of the protests from the citizens, mainly. The school did not become deeply involved in the discussion.

By 1966, the new ramps at Ballas Road had been built and I-270 was completed. In 1974, U.S. 40 was widened, in the median, by two lanes to a total of six lanes.

Ballas Road was also built in the 1930's. It became part of the State Highway System several years later. It is a north/south collector street with a 35 mile per hour speed limit. It carries approximately 12,000 vehicles per day on the two land roadway. The road parallels I-270 for approximately 7 miles and, in some section, acts as both a reliever and a feeder to the freeway.

The area it serves is an upper income residential area. In the past 5 to 10 years, two hospitals have relocated from the inner city to sites between Ballas Road and I-270 north and south of U.S. 40. As could be expected, individual office facilities followed shortly thereafter. Due to this development, traffic on Ballas Road has increased in the past few years. This increase has caused the Highway Department to consider widening Ballas Road to four lanes to accommodate the increased traffic volumes. To date, any mention or even rumor of this has caused the citizenry to angrily protest. Consequently, the widening of Ballas Road has received very low priority.

B. School

Visitation Academy is a private, Catholic girls school owned and operated by the nuns of the Order of the Visitation. The school provides education for girls from 4th through 12th grades. The present building was constructed in 1962 on a 24-acre site with a 1,000 foot frontage along the south side of U.S. 40 and its ramps with Ballas Road. The building is single story brick and contains classrooms and a cloister for the 42 nuns that teach and live on the site. These residences are along the south part of the site. Approximately 500 students attend the school. Of this amount, only about 10% walk. The remaining students drive or are driven to the school. Classrooms and a parking lot are present along the north side of the site adjacent to the freeways and ramps. As a result of the negotiation with the Highway Department over the design of the Ballas Road ramps, the school received title to an additional 8 acres immediately east of this existing 24-acre site. These 8 acres are used as an ecology park for instruction and experimentation. Students generally come from upper-middle and high income families from the west county area. In fact, the school has more applications than they can accept.

C. Proximity Relationships

U.S. 40 through this west central portionof St. Louis County is built on gently rolling terrain. Because the road was constructed many years ago, the grades are approximately that of the natural terrain. Very little, if any grading was done when the road was built. The land use in the area is mainly residential to the north, south, and east. To the west between Ballas Road and I-270 and on both sides of U.S.40, two hospitals are present along with medical office buildings.

The school is at-grade with Ballas Road and the ramps from U.S. 40. The freeway passes over Ballas Road and under I-270 to the west. The ramps are approximately 400 feet from the school buildings and about 200 feet from the parking lot. Ballas Road can be considered a collector type road running parallel to I-270 from Olive Boulevard on the north to Big Bend Road on the south; a distance of about 7 miles. Traffic volumes are in the range of 12,000 ADT.

Traffic controls near the school include signals at the U.S. 40 ramps and Ballas Road intersection and stop controls for the hospital and medical office buildings exists. The Academy's exit is controlled only by a stop sign with Ballas Road having the right-of-way. No sidewalks exist along Ballas Road and crosswalks are not painted across the pavement near the school.

II. IMPACTS

At the time the school was built, there were no concerns about U.S. 40 and any impact it might have on the school. The Order of the Visitation did neither force nor attempt to forecast the traffic volume increase on U.S. 40 that would occur in the future. As traffic volumes increased, however, there were notices of increased noise impacts on the school, especially in the classrooms along the north side of the school building and on the non-sport activities that would take place along that side of the building. The noise level has caused the closing of classroom windows along the north side of the school building and the curtailment of outside, non-sports activities such as graduation and pageants.

The noise levels have not been measured, but the school officials do feel they are excessive. They have investigated the possibility of air-conditioning the classrooms along the north side of the building, but this was rejected due to costs.

No other impacts were noted or expressed by the school officials.

III. MITIGATION

Beginning in approximately 1960, meetings were held by the Highway Department concerning the possible construction of the service road along the south side of U.S. 40 between Ballas and Spoede Roads. These meetings were held with a citizens group composed of homeowners along the south side of U.S. 40. Through the two years of meetings, the citizens were able to successfully argue for the elimination of the service road. The school was minimally involved in this discussion. Only mild letters were placed on record of the school being against the service road.

The Highway Department indicated that in the long run they probably benefited financially by this elimination since it meant less road to build and subsequently maintain and no right-of-way to be acquired.

Due to the chronological time during which the school was built and the ramps serviced, no environmental impact study was required or even contemplated. Today, this would not be the case due to new awareness of environmental factors.

No contact was made with any members of the citizens' group since the people involved in the group have all moved from the residences. This is a common occurrence in this residential area since many of the residents are officers in the large corporations that are either headquartered or have offices in St. Louis.

The school officials expressed an interest in determining if any matching funds would be available to help them "noise proof" their classrooms. They were not aware of any sources of funds for this purpose.

Discussions with the Highway Department indicated that such funds are technically available but only by state option. To date, the Missouri Highway Commission has opted not to use funds for this purpose. They feel that to do so would open a "Pandora's Box" of problems in which any organization or group could claim negative impacts due to the road and that there would not be sufficient funds to accomplish this and improve and construct new roadways.

IV. SUMMARY AND RECOMMENDATIONS

A. Lessons Learned

- The Highway Department has been most responsive to citizens and institutions to the degree possible during the time period of the planning and design of the road. However, most of the recent environmental concerns have only come into the picture in recent years and, therefore, were not applicable to this situation.

- The citizens were successful in eliminating a service road to which they were opposed through this organization. This indicates that the Highway Department was responsive to citizens and their concerns.

- The Highway Department appears caught in a financial dilemma in that Type 2 Project funds would reduce the amount of funds available to use for maintenance and rebuilding of their extensive road system.

B. Suggestions

- The Federal Highway Administration (FHWA) should provide follow-up environmental studies of older freeways and their impact on adjacent land uses. These studies would indicate negative impacts such as has occurred to Visitation Academy and potential solutions.

- Type 2 Project Funds from the Highway Trust Fund should be made available to schools such as Visitation Academy for air-conditioning and sound proofing when such a need is determined from the environmental studies. These funds should be in addition to the funds available to the state for other roadway work. This is especially critical in a state such as Missouri with this large road system.

CHRONOLOGY -- VISITATION ACADEMY

1938-1940	U.S. 40 built as part of WPA project as a four-lane divided roadway.
1945-1949	Master Plan for Freeways in St. Louis prepared showing generalized locations and corridors.
1955	Planning for I-270 (Beltway around St. Louis) initiated. Due to interchange with U.S. 40, the ramping at Ballas Road had to be altered.
1961	Visitation Academy begins construction of new school and cloister.
1962	Academy completed.
1960-1962	Discussions between school, citizens groups, and Highway Department took place relative to a service (frontage) road along south side of U.S. 40 from Ballas Road east.
1962	Design changed to eliminate service road.
1966	I-270 and new Ballas Road ramps completed.
1974	U.S. 40 widened to six lanes in the median.
1970-1975	Highway Department attempts to discuss Ballas Road widening but meet with very negative citizen feelings.

PERSONS CONTACTED: VISITATION ACADEMY

Sr. Francis Marie O'Conner
Principal
The Visitation Academy
3020 Ballas Road
St. Louis, Missouri 63131

Mr. Donald Garrett
District Survey and Plans Engineer

and

Mr. Eugene Borgschulte
District Chief Designer
Missouri State Highway Department
District 6
321 South Kirkwood Road
Kirkwood, Missouri 63121

case study background data

school

McClure Sr. High
1896 S. Florissant Road
Florissant, Missouri 63031
Ferguson-Florissant Reorganized
School District

Grades 10-12, 2,000 students

Two to three-story brick

First construction in 1947, subsequent additions 1961-1962

Main buildings are adjacent to highway ROW and off-ramp

highway

Interstate 270

6-lane freeway, at-grade with school.

Terrain is slightly rolling.

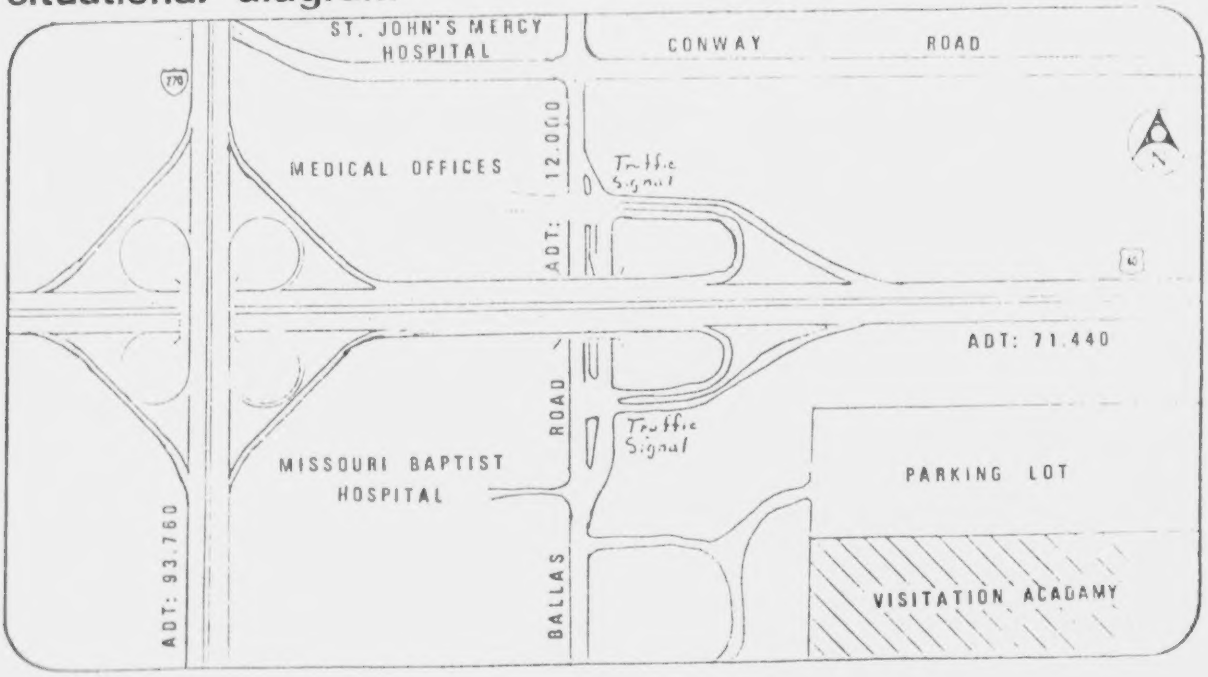
Freeway is belt road around city.

ADT: 65,000

Initial construction 1960 - 4 lanes. Widened to 6 lanes in 1970.

Freeway cannot be further widened in its present ROW.

situational diagram



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I. SITUATIONAL CONTEXT

A. Highway

The present I-270 was first discussed in the late 1940's and early 1950's after the Master Freeway Plan for St. Louis was completed. A need was demonstrated for a route to provide a bypass for I-70 along the northern portion of the metropolitan area. The route selected paralleled an existing road (Dunn Road) which carried Bypass U.S. Route 40 and U.S. Route 66. The route connected with a Mississippi River bridge crossing on the east and a Missouri River bridge crossing on the west. This area of the metropolitan area was also experiencing rapid population increases due to the expansion of industry near the St. Louis Airport.

When the freeway was being planned in detail, the route was laid out through the northern one-half of the present school site. The Highway Department wanted to buy the property and made an offer to the School District. The District felt the amount was too low. This caused the Highway Department to use Eminent Domain procedures to acquire the land.

During the final design stages, the School District indicated that it would expand McClure Senior High School and would like an overpass built in conjunction with this expansion. The request was granted.

In 1970, I-270 was expanded in the median to six lanes. A New Jersey style median barrier was placed between the traffic lanes. No further expansion is possible without the taking of additional right-of-way and the rebuilding of all bridge structures. At this point in time, no planning is being done to consider such a widening

B. School

McClure Senior High School is a public school in the Ferguson-Florissant Reorganized School District. It serves approximately 2,000 students in grades 10-12. Initial construction of the school began in 1947 with expansion being done at some level almost yearly. Major expansion took place in 1961-1962. The buildings are three level brick construction and not air-conditioned.

The District acquired the land from the developed of surrounding residential subdivisions for the purposes of building a high school. The tract was twice the size it is presently. The northern one-half was taken by the Highway Department for I-270.

C. Proximity Relationships

The terrain is gently rolling at this study site with I-270 being built on cut and fill. The rolling nature of the terrain is shown in the Situational Diagram which indicates that I-270 passes over S. Florissant Road and under Washington/Elizabeth Avenues over a distance of approximately half a mile. I-270 remains fairly level over this half mile distance since it was built on cut and fill sections. As a result, the school buildings and the freeway are at-grade with each other.

The land use in the area is generally residential with the typical commercial uses at the intersections of Dunn Road. The school buildings are within 100 feet of the freeway ramps and approximately 150 to 200 feet of the freeway main line. The pedestrian overpass is at-grade with Dunn Road, but above the grade of the school buildings.

Students come to school by bus, cars, and walking. Many of the seniors drive their own vehicle to school. Approximately 30% of the students live north of the school site and, of this 30%, approximately one-third, or 10%, walk and use the pedestrian overpass.

II. IMPACTS

Discussions with school officials indicated the following impacts of the freeway on the school.

- Sound problems are the major impacts. Since the school is not air-conditioned, the windows on the north side of the buildings must be kept open during the spring and fall. This causes teaching effectiveness to be reduced and irritation of the students and teachers to increase.

- The school has air-conditioned certain rooms on the north side of the buildings. These include the music room, driver training, and home economics facility. Even the foreign language lab on the south side of the building was air-conditioned due to the highway noise interfering with the language tapes.

- A study of central air conditioning was completed. The study indicated that it would cost $500,000 to centrally air-condition the school. This cost was prohibitive.

- No decibal readings have been made at the school.

- Consideration was given to closing McClure and relocating the facility to another site. This was done during an earlier time period when the District was still growing rapidly. Today such a move would be prohibitively costly.

- Since there is no freeway service road along the south side of I-270, motorists use the school grounds for access between Florissant Road and Elizabeth Avenue. The District has put up fences and closed some driveways in order to reduce this kind of traffic. However, some cut-through traffic is still experienced.

- The Highway Department has indicated to the District that some vandalism has occurred to the fence on the pedestrian overpass and that students are probably to blame.
- Last year a student climbed the six-seven foot high fence on the pedestrian overpass, jumped, and committeed suicide.
- An additional noise impact experienced by the school not related to the freeway is related to aircraft. The school is in the direct path of the approach to the principal reliever runway at Lambert-St. Louis International Airport. The planes, both commercial and military jets, pass over the school at about 2,000 feet. Airport officials indicate that the flight pattern cannot be changed. This noise problem occurs whenever the runway is in use, about 20% of the time.

III. MITIGATION

The only mitigation that took place was the negotiation over the price of the land purchased by the Highway Department and over obtaining a pedestrian overpass for the school over I-270.

The negotiation for the land took almost a year and finally wound up with the Highway Department using eminent domain procedures to acquire the property they needed. The School District did not fight the decision under these procedures.

The School District was able to obtain the pedestrian overpass as a concession from the Highway Department. The Department felt that since there were two street grade separations at either end of the school with sidewalks, that there was no need for the pedestrian facility. The District prevailed in this situation, however.

No organized citizen opposition was noted during the time of the freeway location studies and hearings. The citizens were merely concerned with the amount of money they would receive for their homes or portions of their land that would be taken for the freeway.

IV. SUMMARY AND RECOMMENDATIONS

A. Lessons Learned

- The Highway Department was as responsive to the situation as required given the guidelines in the early 1960's. They will comply with the most recently published guidelines for various environmental impacts.

- The District was successful in obtaining the pedestrian overpass needed to provide access to the north side of the freeway.

- The Highway Commission has not elected to use Type 2 Project funds to aid in situations of this type due to financial situation.

B. Suggestions

- The Federal Highway Administration (FHWA) should provide follow-up environmental studies of older freeways and their impacts on adjacent land uses.

- Type 2 Project funds should be provided from the Highway Trust Funds for the rectification of the negative impacts of these older freeways as an additional funding source over and above that given to the states as their base amount.

CHRONOLOGY -- McCLURE SENIOR HIGH SCHOOL

1950	Planning for I-270 (St. Louis Beltway) initiated by placing freeway on area system.
1952	Location determined and public hearing on location held. Did not alter freeway route.
1953	Land at McClure was acquired from the school district through eminent domain procedures.
1954	Design of freeway started.
1960	Construction initiated.
1961	School District requested a pedestrian overpass for McClure High School. Request was granted by the Highway Department.
1962	Freeway completed and opened to traffic.
1961-1962	School is expanded.
1970	I-270 is widened in the median to 6 lanes.

PERSONS CONTACTED: McCLURE SENIOR HIGH SCHOOL

Mr. George Fredrickson, Assistant Superintendent

Mr. Phillip Bretch, Past Business Manager, 1957-1972

Mr. Roger Bredenkamp, Past Principal
McClure Senior High School
(By telephone)

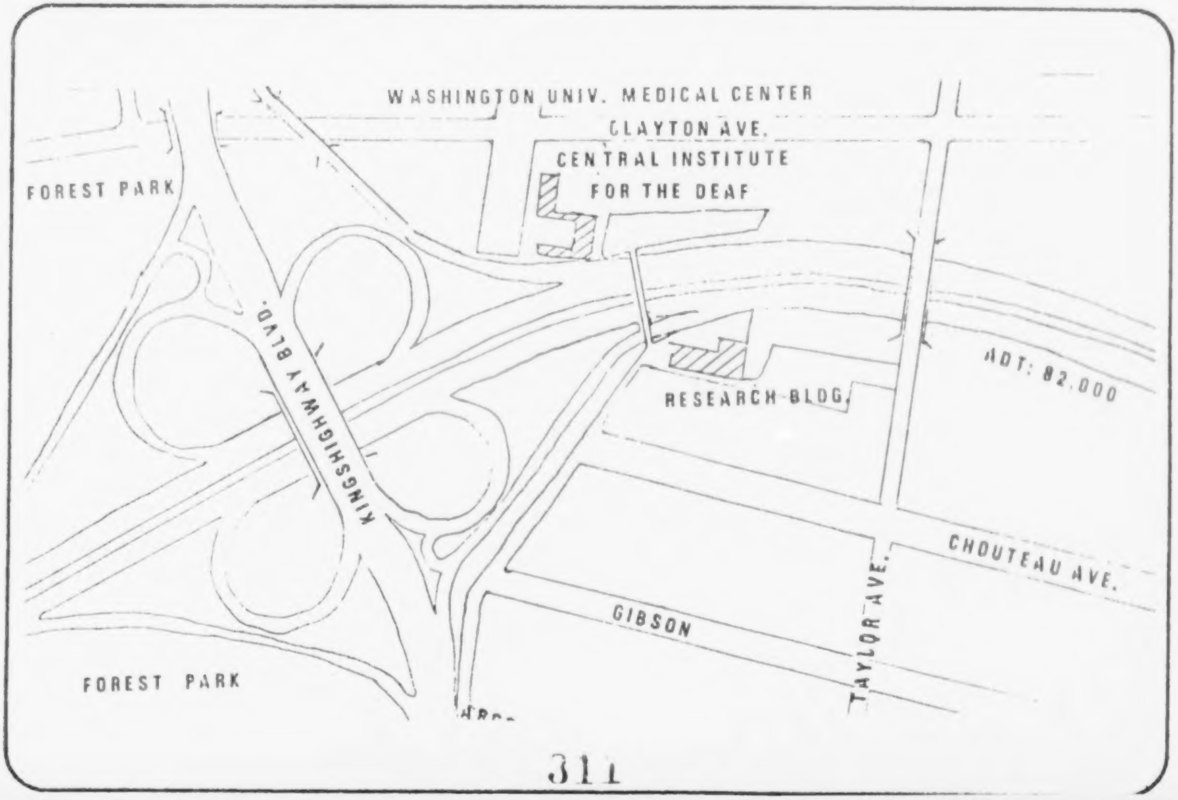
Ferguson-Florissant Re-organized School District
655 January Avenue
St. Louis, Missouri 63135

Mr. Donald Garrett
District Surveys and Plans Engineer
Mr. Eugene Borgschulte, District Chief Deisgner
Missouri State Highway Department
District 6
321 South Kirkwood Road
Kirkwood, Missouri 63122

case study background data

school	highway
Central Institute for the Deaf St. Louis, Missouri 63110	U.S. 40
Private, Not-for-Profit Pre-school through 15 years 135 Students Multistory brick classrooms and research buildings Facilities split by freeway and connected by pedestrian bridge	U.S. 40 -- built in 1938 Widened to 6 lanes in 1964 Scheduled expansion to 8 lanes (in median) by 1983-1984 Approximately 25 feet below grade with retaining walls ADT: 82,000

situational diagram



I. SITUATIONAL CONTEXT

A. Highway

The Red Feather Highway was built in the late 1930s as part of the Works Progress Administration (WPA) Program along the present alignments. The highway was slightly over three miles in length and limited access. It was a forerunner of future freeways throughout the country. From the present study site to the eastern end of the freeway, a distance of one mile, the road was built in a "concrete canyon." The roadway was 44 feet wide with four, 10-foot lanes and a four-foot median with guardrail. Six-foot wide shoulders were provided on each side of the roadway. The "canyon" was approximately 20 feet deep and had very sharp curves.

The 1940's Freeway Master Plan for the St. Louis area indicated a need to rebuild this roadway and provide for eventual widening to eight lanes. The actual planning for this widening and rebuilding started in the mid-1950s with construction starting in 1961 and completion in 1964.

In approximately 1969, planning began for the elimination of a bottleneck to the east of the study site. The bottleneck was a four-lane bridge facility called the Vandeventer Overpass. Included in this planning is the eventual widening of U.S. 40 to eight lanes from the new Vandeventer Overpass to the western end of Forest Park. This is the extent of the original Red Feather Highway.

Late last year, 1976, contracts were let for the design of the new Vandeventer Overpass. Nothing has been done with regard to the median widening of the remainder of U.S. 40. No design contracts have been let, no impact studies started, and no public hearings scheduled. This will all be done in the future as funds become available. The anticipated completion date for both projects is 1983-1984.

The road is the major east-west freeway in the metropolitan area providing access from the western suburbs to the St. Louis CBD. It is one of the most heavily used freeways in the metro area and the entire state. In fact, a traffic count immediately west of the St. Louis City Limits indicated that in 1976 a total of 106,800 vpd used this six lane freeway in an average 24 hour period. This is the highest traffic volume count in the state. Traffic volumes are fairly consistent throughout the day with some peaking characteristics, but not of the normal magnitude that would be expected on such a facility. Estimates of peak hour traffic indicate it to be approximately 7.5 percent of ADT.

B. Schools

The Central Institute for the Deaf (CID) is a private, not-for-profit institution providing teaching and research for the hearing impaired child between pre-school and 15 years. A total of 135 students attend the school. They come from all areas of the country and all socioeconomic backgrounds. The initial buildings were constructed in 1915 with the first major expansion taking place in 1949 and 1950. This expansion included the construction of the research building on its present site south of U.S. 40. The buildings of CID are mainly multistory brick with some buildings being homes that are in the nearby neighborhood and are used to provide "homelike" atmospheres for some of the students. Most students live at CID with only a very few being commuter or day students.

CID was built on both sides of the freeway mainly for economic reasons. At the time (1950s) of the expansion on the south side of U.S. 40, no property was available to CID on the north side at a price they could afford. Therefore, when the present property became available, they obtained it and built their research facility and the original pedestrian overpass.

A second school indirectly affected by the freeway is the Stix School, an elementary school of the St. Louis Public Schools serving grades K-8. This school is approximately six blocks north of CID on Euclid Avenue. The attendance boundary for the school includes the residential area south of U.S. 40. Consequently, students from the Stix School use the pedestrian bridge across U.S. 40. The school has an enrollment of approximately 350 students. Of that total, about 25 percent live south of U.S. 40 and of that total, about 30 to 40 students walk and use the overpass.

C. Proximity Relationships

U.S. 40 is the major east-west freeway running through the central part of the St. Louis region. Land use in the area surrounding CID is quite mixed. To the west is Forest Park, at 1,300 acres, the major park facility for the city containing many of the regions cultural facilities. To the south and southeast is an older residential area of small single family and two to eight family residential structures. To the north is the Washington University Medical Center with 16 hospitals and medical related teaching institutions and 13,000 employees. This area is growing and anticipates an employment level of over 20,000 by 1995. To the east and northeast is an area of mixed residential, industrial and commercial uses that is undergoing extensive redevelopment.

The present U.S. 40 is approximately 20 feet below grade as it passes CID. A cloverleaf interchange with Kingshighway Boulevard is immediately west of CID. Kingshighway Boulevard is a major north-south artery carrying about 50,000 ADT. The CID buildings are within 25 to 50 feet of the top of the freeway retaining walls. A pedestrian bridge connects the two CID buildings on either side of the freeway. A low chain link fence, four to five feet high, protects the pedestrian on this bridge.

No control exists at the overpass and no crossing guard is provided. The students cross the bridge on their own. A sidewalk is provided on the Taylor Avenue Bridge over U.S. 40 and some Stix School students would use that sidewalk instead of the CID overpass.

The terrain in the area is flat to gently rolling. Most of any major grade changes have long since been removed due to the age of the development in the area. Some of this development dates to the early 1900s to the 1920s.

II. IMPACTS

The discussion with CID officials indicated that historically, at least until the 1950s, the freeway was not a problem to them or their institution. At the time the original highway was built, 1930s, obviously there was no concern about its environmental impacts. This same situation prevailed also during the late 1950s and early 1960s when the freeway was rebuilt and widened. In fact, the main concern about the widened freeway centered on the relocation of some cit- greenhouses located in Forest Park, west of CID. The taking of park land for the freeway was not even much of an issue at that time.

However, during the widening itself and subsequent to it, several impacts were noted by CID officials.

- The transient impact of the actual construction. This caused great concern because of the noise, dust and dirt which accompanied the projects and disrupted much of their teaching and research. CID officials expressed concern to the contractor who accommodated them as much as possible. The most important factor in eliminating theproblems was the contractor's ability to complete the project 18 months ahead of schedule.

- The noise problem related to traffic. Some background information on CID will help focus the actual impact of these noise levels on their work. In the research building experiments are conducted with the hearing impaired as well as the deaf child. All of these experiments deal with sound and a child's perception of the sound. In order to conduct these experiments, very exacting and sensitive measuring devices are used along with varying levels of sound amplification. In fact, some of the research requires placing electrodes on a single brain cell to determine its reaction to various levels and types of sound. Obviously, these experiments must be conducted in as soundproof an environment as possible.

The noise impact occurred during the rebuilding and does presently occur from the freeway traffic volumes. Noise readings of 80 dBa have been recorded by CID at the pedestrian bridge and of 70 dBa on the outside of the third floor of the research building. This is air borne noise emanating from the freeway. No readings have been taken inside the buildints, but estimates of 50 dBa have been made. These readings have not been made known to the Highway Department as of this study.

The noise impact, then, from the highway has had a tremendous negative impact on CID and their research. In fact, very sensitive research experiments have been moved to the basement of the research building to eliminate air-borne noise impact. The impact on teaching and other less sensitive experiments is almost as severe because CID cannot air condition their buildings due to the cost involved of not only the initial installation, but, more importantly, the operating expenses.

- A resultant drainage problem. After the freeway widening, CID noticed that long the new retaining wall, there was poor drainage. This resulted in some rather large pools of standing water in the playground area. Obviously, the results in reduced usage of these play areas as long as the water remains. CID officials have attempted to get the problem resolved, but have yet not been able to.

- The overpass. Both CID and some of the local citizens are concerned about the safety of the pedestrian overpass for CID and Stix School students. The citizens and CID officials would like to see the overpass completely enclosed by chain link fence, including the top. The previous overpass was protected in this way and was acceptable to the parents and CID. This concern has been expressed to the Highway Department, but nothing has been done.

III. MITIGATION

The only mitigation that occurred in this case study was the negotiation between CID and the Highway Department for property and compensation and for the pedestrian overpass. No mitigation relative to noise and its impacts took place.

Two reasons for this lack of mitigating noise impact can be determined. One, CID had been adjacent to the old highway and, therefore, probably came to "live with" the situation. Two, no recognition of noise impacts was present during the time period that the planning and design of the freeway took place.

There will be, however, noise and other environmental impacts determined for the new widening scheduled for completion in 1983-1984. These impacts will be determined with the EIS's are completed.

Other minor negotiations have taken place relative to the drainage problem and trying to get the overpass completely covered. Nothing has been accomplished to date with this.

IV. SUMMARY AND RECOMMENDATIONS

A. Lessons Learned

The Highway Department was as responsive to the situation as required, given the guidelines in the early 1960s. They will comply with the most recently published guidelines for various environmental impacts.

CID was successful in obtaining the pedestrian overpass needed to connect its facilities on both sides of the freeway.

The Highway Commission has not elected to use Type 2 Project funds to aid in a situation of this type due to financial situation.

B. Suggestions

The Federal Highway Administration (FHWA) should provide follow-up environmental studies of older freeways and their impacts on adjacent land uses.

Type 2 Project funds should be provided from the Highway Trust Funds for the rectification of the negative impacts of these older freeways as an additional funding source over and above that given to the states as their base amount.

CHRONOLOGY -- CENTRAL INSTITUTE FOR THE DEAF

1915	Central Institute for the Deaf (CID) builds first structure on the north present site.
1938	Red Feather Highway (U.S. 40) built was WPA Project: four lanes, divided by guardrail, 10-foot lanes, 6-foot shoulders, 4-foot median, retaining walls.
1945-1949	Master Plan for Freeway in St. Louis prepared showing location and corridors.
1950	Research building constructed on south side of Red Feather Highway and overpass built to connect two sections of CID and provide access to the nearby Stix Public Elementary School.
1955	Planning for U.S. 40 widening began.
1958-1962	Negotiations between the Highway Department and CID over CID property needed for widening project. CID received a parcel of land immediately east of the existing classroom building on the north side of U.S. 40 for a playground, a crosswalk with chain link fence, and cash.
1964	Widening of U.S. 40 completed.
1969	Planning for elimination of bottleneck of U.S. 40 east of the study site began. This included, eventually, the need for widening of U.S. 40 at the study site to eight lanes. The widening will be in the median.
1976	Design contracts for bottleneck improvements let.
1983-1984	Anticipated completion date for U.S. 40 widening and bottleneck elimination.

PERSONS CONTACTED: CENTRAL INSTITUTE FOR THE DEAF

Mr. Dennis Gjerdingen, Director
Dr. S. Richard Silverman, Director Emeritus
Dr. Arthur Niemoeller, Accoustics Research Associate
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St. Louis, Missouri 63110
(by telephone)

Mr. Donald Garrett, District Survey's and Plans Engineer
Mr. Eugene Borgschulte, District Chief Designer
Missouri State Highway Department
District 6
321 South Kirkwood Road
Kirkwood, Missouri 63121

case study background data

school

Gove Junior High
Denver, Colorado 80206

7-9, 720 students
1976
Two-story stucco

highway

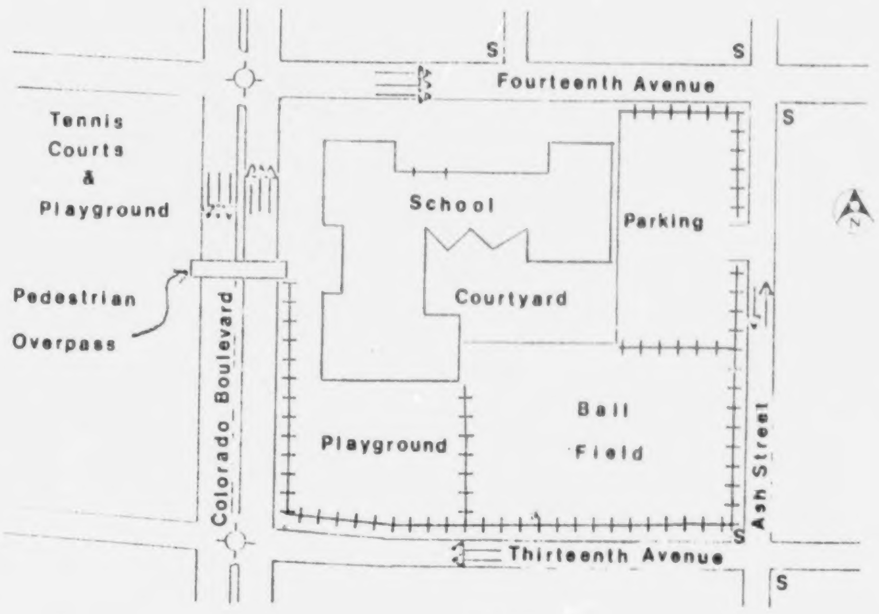
Colorado Boulevard
14th Avenue
13th Avenue

Colorado Boulevard (Colorado Route 2)
6-lane divided with raised median
N/S Principal Arterial
At grade
ADT: 42,500 vpd (1976)
Speed Limit: 35 mph

14th Avenue
3-lane one-way feeder (EB)
At grade
ADT: 11,900 vpd (1976)
Speed Limit: 30 mph

13th Avenue
2-lane one-way feeder (WB)
At grade
ADT: 11,200 vpd (1976)
Speed Limit: 30 mph

situational diagram



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I. SITUATIONAL CONTEXT

A. Highway

Gove Junior High School is located on the east side of Colorado Boulevard (Colorado State Highway 2). Colorado Boulevard is one of the busiest principal arterials in the city and probably in the state. It has three lanes of travel in each direction divided by a planted median. It is aligned in the north/south direction and has a posted speed limit of 35 mph. The street carries heavy traffic at all times of day and includes considerable truck traffic and emergency vehicles. Its current ADT is approximately 42,500 vehicles per day. Even though it is a state highway, because it is within the city limits, the city has responsibility for daily maintenance, control and operation of the street. This includes all signs, signals, and pavement markings. The State Highway Department is responsible for any major reconstruction of Colorado Boulevard.

Although Colorado Boulevard is the busiest street adjacent to the school, it is not the end of the school's problems. On the north and south, the school property is bordered by a pair of one-way feeder streets which lead to the downtown. On the north, 14th Avenue is a three-lane eastbound (away from downtown) street. Its current ADT is 11,900 vehicles per day and the posted speed limit is 30 mph. Adjacent to the school property on the south is 13th Avenue, a two-lane westbound (toward downtown) street. It widens considerably at the intersection of Colorado Boulevard to provide turning lanes. The posted speed limit is also 30 mph and the approximate ADT is 11,200 vehicles per day.

B. School

Gove Junior High School is a public school with an enrollment of about 720 students in grades seven through nine. Its primary service area is approximately bounded by University Avenue (about one mile west of Colorado Boulevard) on the west, Bellaire Street (two blocks east of the school) on the east, Colfax Avenue one block away on the north, and 10th Avenue on the south (three blocks south of the school). In addition, the school is attended by about 180 students residing in an area no-th of the primary service area and bounded by 23rd Avenue, 28th Avenue, Bellaire Street, and Fillmore Street. These students are not bused to school because the area is within two miles of the school location, which is the minimum distance established by the school district before busing of junior high school students is authorized. Furthermore, about 200 students are bused to Gove Junior High School from southeast Denver.

The original Gove School was constructed in 1911 on the west side of Colorado Boulevard. It was a two-story masonry structure with its front entrance facing Colorado Boulevard. In addition, other buildings were subsequently built to support the original school. In the same block to the south, a metal building was constructed to serve as the industrial education shops; to the north of the building, five portable buildings were constructed for use as classrooms. The school district also owned the property across the street on which the current school now sits. This property was utilized for play fields and tennis courts.

In approximately 1970, planning began for the new school. The logical location was across the street on the property already owned by the school district. The new school, completed in February 1976, is a two-story stucco structure situated on the property which is approximately two blocks in size. In addition to the building, the property includes playground, parking lot, and playing fields. The playground and playing field are totally fenced. The building itself is designed with minimal windows along Colorado Boulevard; the only exceptions are located in the middle of the building, a section which is further set back from the highway. The main entrance to the school is designated on 14th Avenue; however, the heaviest use of any entry to the school seems to be in the courtyard area to the rear of the building.

The site of the original school was retained by the school district and is now used primarily for tennis courts and other playground facilities. This area is used on a regular basis by classes from Gove Junior High School and the Two sites are connected by a pedestrian overpass.

In addition to its everyday use as a school, Gove School is one of the few truly community schools in Denver. That is, it receives heavy use after school hours and during the summer months by a number of community groups. Musical groups and thespian groups use the school's facilities and athletic groups, both organized and non-organized, use the playing fields heavily.

C. Proximity Relationships

The school is situated on the northwest corner of the lot adjacent to Colorado Boulevard and 14th Avenue. Along Colorado Boulevard, the building is set back a minimum of 55 feet. The building is slightly higher in elevation than the street because the ground slopes gently to the east. Along 14th Avenue, the classroom portion of the school is set back approximately 80 feet from the street. A section of the school is only 45 feet from 14th Avenue, but this section houses only industrial education shops.

The intersections of 13th Avenue/Colorado Boulevard and 14th Avenue/ Colorado Boulevard are both signalized. There are no separate pedestrian signal indications at these intersections, but they are both controlled by pedestrian-actuated buttons.

One block to the north is the intersection of Colorado Boulevard/ Colfax Avenue. With these two streets being two of the most heavily traveled facilities in their representative directions, this intersection is one of the busiest intersections in the city. Adjacent to the school on the north is the National Jewish Research Center. South of the school along Colorado Boulevard is the University of Colorado Medical Center Complex and related facilities.

II. IMPACTS

In the words of the school principal, "Our biggest concern is traffic safety." It was noted that one cannot educate the students if one cannot get them to the school safely. Being surrounded on three sides by major traffic facilities, there is considerable exposure of school children to fast-flowing traffic. The problem is compounded by the fact that junior high schools do not qualify for guards under the school crossing guard program.

In the past and today, classes must cross Colorado Boulevard on a regular basis. This movement is much safer now with the pedestrian overpass, but strict control is still necessary. Prior to the construction of the overpass in late 1966-early 1967, a tragedy occurred. While a gym class was crossing Colorado Boulevard to utilize the playing field, two students were struck and killed by a vehicle. This accident served to highlight the seriousness of the problem at Gove School and to spur the appropriate organizations into action.

Another problem related to access involves the safe loading and unloading of school buses at the school. Prior to the mandatory busing in Denver, most schools had very few students who were bused. Now, however, at Gove School nearly 30 percent of the students are bused. Heavy traffic on three of the streets, and particularly the two nearest to the school, makes it very difficult and hazardous to load and unload along these streets. Therefore, buses were originally circulated through the parking lot in the rear of the school with its drive on Ash Street. Several problems made this operation difficult. First, the maneuvering of the buses in the lot was difficult and the buses were forced to mingle with autos using the lot.

Secondly, in the winter, it was often difficult for the buses to negotiate the slight grade on the drive when exiting the lot. Thus, the bus loading zone is currently on Ash Street and the appropriate signing is displayed along the entire length of that block. This plan operates favorably as far as the school is concerned, but has earned the disfavor of the residents across Ash Street who have complained of noise due to the buses.

Many of those students who come to school from an area north of the primary service area use public transportation, principally the Regional Transportation District (RTD) bus routes operating along Colorado Boulevard. It is estimated that enough students use this service to fill one bus. There have historically been bus stops located directly in front of the school; however, this has proven to be unacceptable for several reasons. First, with the relatively high number of students using the buses, the boarding and unboarding times are longer than those experienced at a typical bus stop. These lengthier stops create congestion problems on heavily traveled Colorado Boulevard. Secondly, in the morning, the students must cross Colorado Boulevard to get from the bus stop to the school. Rather than use the pedestrian overpass, students will often take the shortest path -- directly across Colorado -- thereby exposing themselves to considerable traffic.

The final impact which the school experiences is that of noise generated by the traffic on the adjoining streets. Not only is the traffic heavy throughout the day, but there is also an unusually high number of emergency vehicles along Colorado Boulevard, particularly ambulances destined for the medical facilities in the area. The situation was considerably worse in the old building; much of the problem has been minimized by the planning and design of the new school.

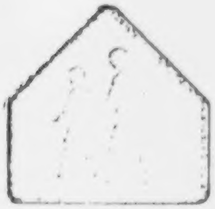
III. MITIGATION MEASURES

As noted earlier, in 1965 a tragic accident occurred while students were crossing Colorado Boulevard. As a result, the Highway Department and the City, with added pressure from parents, began to seriously consider alternatives to improve safety at the crossings. Because the movement was made on such a frequent and regular basis throughout the day, it was decided that a pedestrian overpass was the best solution. In 1966, $51,000 was appropriated by the City Council for construction of the overpass. (It is estimated that a similar structure constructed today would probably cost approximately $200,000.) In early 1967, the overpass was completed. Although it is not mandatory for students to use the overpass on their way to and from school, it is strongly encouraged and promoted by constant reminders to the students. A large percentage of the students do use the overpass. As a matter of policy, the principal of the school requires that all students involved in a class movement to the other side of Colorado Boulevard must use the overpass.

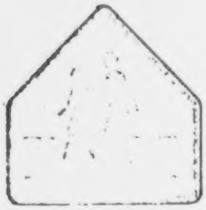
The Traffic Engineering Division of the City has implemented a number of other traffic control devices to help mitigate the pedestrian safety problems. The City has a policy of using twelve-inch red signal indications on all signal installations at intersections where school crossings occur. (Typical size indication is only eight inches.) It is believed that this may help to minimize the chance of motorists running through a red indication due to lack of visibility.

On the busy one-way streets, 13th and 14th Avenues, the Traffic Engineering Department has installed School Advance Signs (S1-1 shown below) and/or School Crossing Signs (S2-1 below) in accordance with the manual on Uniform

Traffic Control Devices. They are installed on both sides of the streets on one-way streets.



S1-1
36" x 36"



S2-1
36" x 36"

In addition, the signalized intersections at Colorado Boulevard have been signed with "No Turn on Red When Children Are Present" signs. These signs are frequently requested by parent groups and are installed by Traffic Engineering to help to minimize auto-pedestrian conflicts due to turning movements. There are, however, some doubts among traffic engineers about the usefulness of these because the only crosswalks which should be occupied when the signal indication is red to the motorist are those walks directly in front of his vehicle. Thus, visibility should not be a problem. It is, therefore, believed that these signs may only add to the visual clutter at intersections. Critics will respond, however, that at least the signs provide additional warning to motorists that there is a school crosswalk located at the intersection.

The Traffic Engineering Department will not place school crossing guards at Gove Junior High because the school is not an elementary school. To overcome this deficiency, the principal has established a program of using staff members to attend the crosswalks. Through this program, three intersections and the pedestrian overpass are attended by teachers fifteen minutes prior to school and fifteen minutes after school. A weekly duty roster is established for this program and it is closely monitored to insure that duties are fulfilled. Teachers do not act as crossing guards and do not control traffic, but their mere presence acts as a reminder to the children to properly use the crosswalks. Many schools will not use such a program because of the fear of legal implications in the case of an accident, but at Gove School safety of the students is of utmost concern and the teachers serve their duties accordingly. The program has been highly successful.

The problem of the bus stops located on Colorado Boulevard and their inherent lack of safety was also attacked directly by the principal. By working with staff members of the Regional Transportation District and impressing upon them the related safety problems, arrangements have been made to modify the bus service in the immediate area of the school. Certain routes on specific schedules (those used by the students) are now routed off Colorado Boulevard via 14th Avenue to Ash Street behind the school, drop the students off at Ash Street like the other school buses, and return to Colorado Boulevard via 13th Avenue. Additionally, as necessary and when feasible, RTD has made minor modifications to its schedules to better meet the needs of the school children. This relationship between RTD and the school has been most beneficial.

The issue of noise was considered in the planning and design of the new school. Similar to other new school projects in the district, a Design Advisory Committee was established to assist in the planning and design of the facility. This committee consisted of school district planning department staff, the principal and other school staff, community members, and the city planning department. When formed, the committee was given the site, the size of the school, and the budget. Considerations given to noise in the design included:

- Setbacks from the street considerably greater than those at the old school.
- Minimum number of windows on the side of the school adjacent to Colorado Boulevard.
- Air conditioning throughout the school.
- Location of the school closer to 14th Avenue rather than 13th Avenue. Because 14th Avenue is eastbound only, the peak traffic on this street occurs late in the afternoon as people are leaving the downtown. This peak is after school hours and, thus, the impact of the traffic is minimized.

All of these measures were included on only a subjective basis. No noise monitoring or other specific analyses were conducted.

IV. SUMMARY AND RECOMMENDATIONS

A. Lessons Learned

Pedestrian overpasses can be effective means to improve safety at heavily used school crossings. However, they are also very costly and all other measures should first be considered. In addition, supervision is important to insure that students use the overpass.

Supervision at crosswalks is very important and can be successful at junior high schools as well as elementary schools. Although the children are at an age when they are less receptive to discipline, the mere presence of an adult at crossings is beneficial as a reminder to the students to use the crosswalks.

Often agencies providing services in the area of the school are not necessarily aware of how their service interacts with the school and, thus, their operation may not be best suited to the school. However, if approached by the school and made aware of the interactions, such agencies can and will often made modifications with only minor impact to their operations which would greatly enhance the school operation.

Although one-way streets often cause hardships on schools, their effects can be minimized by properly evaluating their daily traffic patterns and planning around those patterns.

B. Suggestions

It has been suggested that every effort should be made to expand the school crossing guard program to include junior high schools. The staff effort at Gove School has proven that control can be effective at junior highs. Suggestions have also been made that the school district could possibly help in financially supporting expansion of the program.

The Design Advisory Committee concept is very beneficial and could possibly be expanded to establish a similar committee at all schools which can serve as a body to continuously monitor the need for improvements.

CHRONOLOGY -- GOVE JUNIOR HIGH SCHOOL

1965	While a gym class is crossing Colorado Boulevard to utilize the playing fields, two students are struck by a car and are fatally injured.
1966	The crossing situation is closely scrutinized by the City and the State Highway Department. City Council appropriates funds for the construction of a pedestrian overpass.
1967	The pedestrian overpass is completed early in the year.
1970	Planning begins for new school and the Design Advisory Committee is established.
1976	In February, the new school is completed and is occupied. As the year progresses, several plans are tried for routing school buses and loading zones are finally established on Ash Street. The principal arranges with RTD to reroute buses onto Ash Street.

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Deputy Director
Traffic Engineering Division
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school

Barrett Elementary School
2900 Jackson Street
Denver, Colorado 80205

K-3, 413 students
1960
Two-story brick

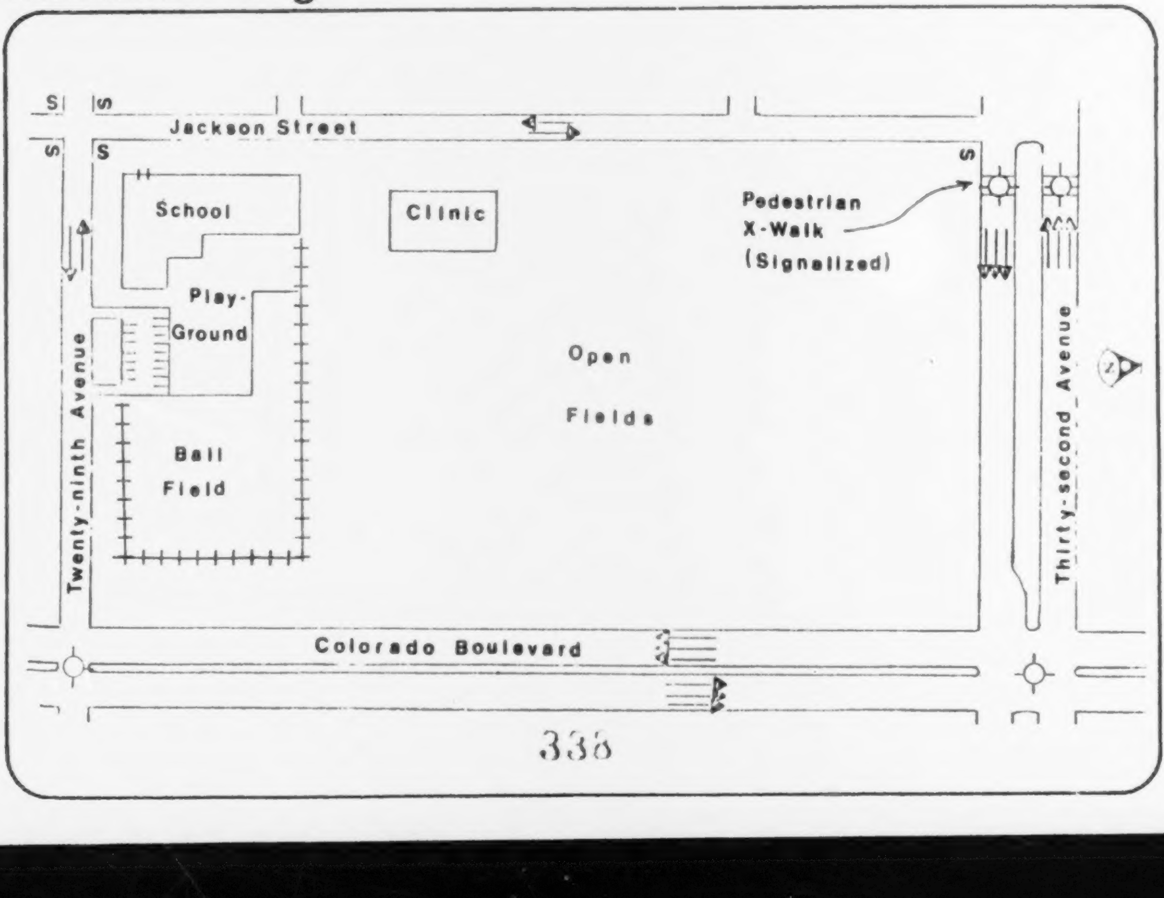
highway

Colorado Boulevard
32nd Avenue

Colorado Boulevard (Colorado Route 2)
6-lane divided with raised median
N/S Principal Arterial
At grade
ADT: 35,600 vpd (1976)
Speed limit: 35 mph

32nd Avenue
6-lane parkway with 30-foot landscaped median
E/W principal arterial to airport
At grade
ADT: 23,000 vpd (1976)
Speed limit: 35 mph

situational diagram



I. SITUATIONAL CONTEXT

A. Highway

The school property on which Barrett Elementary School is situated is bounded by 29th Avenue on the south, 32nd Avenue on the north, Colorado Boulevard on the east, and Jackson Street on the west. Jackson Street and 29th Avenue are only two-lane, two-direction city streets which carry relatively low traffic volumes. The intersection of these two streets by the school is controlled by a four-way stop condition.

Colorado Boulevard, however, is probably the most heavily traveled principal arterial in the City, if not in the State of Colorado. It is a State Highway (Colorado 2) and is six lanes wide with a raised median. Running in the north/south direction, Colorado Boulevard carries approximately 35,600 vehicles per day in the vicinity of Barrett School. This route is not only heavily used during commuter hours, but carries high traffic volumes throughout the day.

Likewise, 32nd Avenue is also an extremely busy principal arterial. It is aligned in the east/west direction and serves as the most direct route between downtown Denver and Stapleton International Airport, the eighth busiest airport in the United States. The ADT on 32nd Avenue in the vicinity of the school is about 23,000 vehicles per day. The street is designed as a parkway with three lanes in each direction divided by a 30-fooot-wide landscaped median. To the east of colorado Boulevard, the median decreases in width considerably. The posted speed limit is 35 mph.

B. School

The school is situated on the northeast corner of the intersection of Jackson Street/29th Avenue, with the main entrance to the building facing onto Jackson Street. The building is a two-story brick structure basically in the shape of an "L." The leg parallel to 29th Avenue includes offices, lunch room and gymnasium; the section parallel to Jackson Street contains the classrooms and has windows on both sides of the building.

It is a public school in the Denver Public School District and currently serves kindergarten through the third grades. Prior to last year, the school accommodated students in grades one through six. The school is currently running at 92 percent capacity with 413 students enrolled; this compares with the capacity of the school of 450 students.

The school was built in 1960 on a piece of property purchased by the Denver Public School District a few years earlier. The original intent of the school district was to build both Barrett Elementary and a junior high school on the same piece of property. However, after the elementary school was constructed, the courts decided that the school district could not build the junior high school. Therefore, a large portion of the property remains vacant. No new construction has taken place at the school since its original construction in 1960.

Until 1974, the service area for Barrett Elementary School lay totally to the west of Colorado Boulevard and primarily south of 32nd Avenue. However, in 1974, at the direction of the U.S. District Court, the Denver Public School System was forced to integrate its schools. This resulted in changing many of the school boundaries. Dr. John Finger, an East Coast consultant, was hired by the school district to set up the integration process. A computer model was used to determine where the revised school boundaries should lie.

As a result, the boundaries for the Barrett Elementary School changed dramatically. The school boundaries are now situated such that approximately 90 percent of the service area lies to the east of Colorado Boulevard and/or north of 32nd Avenue. It is estimated that approximately 80 percent of the students now live on the opposite side of Colorado Boulevard from the school. Some portions of the school area even lie at a distance greater than one mile from the school, which therefore requires students from that small area to be bused to the school. Only a very small portion of the students come from the neighborhood immediately adjacent to the school.

C. Proximity Relationships

In addition to the school, other uses on the school property include a diagnostic center and a children's botanical gardens. Both lie to the north of the school.

The neighborhood immediately adjacent to the school is primarily residential in nature. However, to the south of the school along Colorado Boulevard, the land use is primarily strip commercial. To the north of the school district property across 32nd Avenue is the Clayton School for Boys, a home for orphaned and problem children which is funded through a private endowment. Across Colorado Boulevard from the school is also primarily residential neighborhoods.

The school at its closest point lies approximately 425 feet from the edge of Colorado Boulevard. The portion of the school which contains most of the classrooms is approximately 500 feet from Colorado Boulevard. Between the school and the street are a paved playground and open playfields which are surrounded by a chain-link fence. The chain-link fence lies approximately 100 feet from Colorado Boulevard; the 100 feet along Colorado Boulevard is State Highway Department right-of-way.

Thirty-second Avenue is about 800 feet north of the school. The building is set back approximately 40 feet from both 29th Avenue and Jackson Street. The terrain is flat and, thus, all of the streets and arterials lie at grade with the school.

The intersections of 32nd Avenue/Colorado Boulevard and 29th Avenue/Colorado Boulevard are two of the primary crossing points for students and are both signalized. The 32nd/Colorado intersection is fully channelized to provide separate turning lanes for movements in all directions. Separate pedestrian signal indications are also provided. The intersection at 29th/Colorado, although signalized, does not have pedestrian indications.

The other major student crossing is located across 32nd Avenue at a point approximately 50 feet east of Jackson Street. Although not at an intersection, it is controlled by a pedestrian-actuated traffic signal. Because the median is relatively wide at this point, the signals on the two sections of the street (one in each direction) are activated separately by pedestrian buttons located on each side of the street and in the median. Separate pedestrian indications are also provided at this crosswalk.

II. IMPACTS

At the time of the selection of the property for the school, there were no concerns about impacts on the school related to the nearby major street facilities. At that time, it was assumed that school boundaries would most likely utilize Colorado Boulevard as one of its limits. Because of the distance between the school and Colorado Boulevard, there are not the usual impacts of air and noise pollution or other distractive features of the highway.

Until 1974, when the school boundaries changed, school personnel felt no impacts of the highway. However, the change in boundaries created a major impact in regards to safety of the children in accessing the school. The need for a large majority of the students to cross either or both Colorado Boulevard or 32nd Avenue caused concern not only among the school staff, but also among the parents. The safety of children in the age group of 5 to 12 years was of major concern. Now that grades enrolled at the school have been changed, the age group is even lower (5 to 8 years) and the problem becomes more serious.

The only other impact which has been noted at the school, but in no measurable means, has been that fewer parents seem to visit the school either during the day or in the evening hours. It has been hypothesized that this is the result of the fact that the major arterials create natural barriers between the school and the residences of the families.

III. MITIGATION MEASURES

Beginning on the first day of school in 1974, parents began to continuously call the principal to express their concern over the fact that their children were crossing some of the busiest arterials in Denver to reach the school. No special precautions had been taken to insure the safety of these students in those crossings. The principal, equally concerned, began to take action to notify school district personnel and other individuals and agencies responsible for the safety of school children. His first action was a memorandum sent to the Director of Safety at the school district requesting consideration of the safety problems. This is the appropriate procedure for matters of this kind. It is then the responsibility of the Director of Safety to contact the School Safety Unit at the City Traffic Engineering Division.

The parents quickly became well organized to indicate their strength and their commitment to their concerns. They contacted TV stations and the press to make sure that the public was aware of their concerns. They indicated that unless actions were taken, they were going to boycott the school. Contacts were also made with a state senator who lives in the neighborhood to convince him of their plight. The response to their pleas was immediate. Public meeting were held which were attended by the school board, the traffic engineering department, and the traffic safety coordinator for the school district. The parents indicated that they believed that an overpass constructed over the intersection of Colorado Boulevard and 32nd Avenue would be the best answer to the problem.

The Traffic Engineering Department conducted a review of the situation and found that most of the usual traffic control techniques for school crossings were already in place at the primary intersections. First, the intersections were controlled by traffic signals. Secondly, standard School Advance signs were in place in all four approaches to the intersection of 32nd/ Colorado and on the major street approaches at the other intersections. In fact, on both 32nd Avenue and Colorado Boulevard, because they are divided highways, twice as many signs as usual were in place--one on the right side as in the standard and one on the left side in the median. Thirdly, "No Turn on Red While Children Are Present" signs were in place at the signalized intersections. Lastly, the intersections were properly painted with standard stop bars and crosswalks. Consideration was given to the construction of a pedestrian overpass at the 32nd/Colorado intersection, but it resulted in a negative response for several reasons:

- It would be extremely costly.
- Overpasses are not properly used unless under strict supervision.
- The busing program is not necessarily permanent and could be revised in a few years, resulting in no need for an expensive structure.

Consideration was also given to the request to lower the speed limits on Colorado and 32nd. At the time, Traffic Engineering had six test locations of such situations scattered throughout the City, but there did not appear to be any beneficial results from the study. Again, the cost of installing the warning signal installations necessary would be considerable with no benefit which could be identified.

After the review, it was decided to provide crossing guards on the streets. Such crossing guards were provided by the Traffic Engineering Department at the intersection of 29th and Colorado, the intersection of 32nd and Colorado, and the intersection of 32nd and Jackson. These intersections are still manned by crossing guards throughout the day. The approximate hours of staffing are from 8:00 to 9:15 AM, 11:30 AM to 1:30 PM, and from 3:00 to 4:15 PM. During mid-day, the crosswalks are used primarily by kindergarten children because the kindergarten operates on a split shift. That is, one section of kindergarten classes is held in the morning while a second group of students is handled in the afternoon. The crossing guards are hired and paid by the City Traffic Engineering Department as part of the School Crossing Guard Program.

However, the parents did not believe that the crossing guards provided sufficient safety for their children. They demanded that the school district consider the possibility of busing the children to the school. Initial reaction to this suggestion was negative because it was in strict violation of the district's policy to bus only those children living more than one mile from their school. In addition, it was feared that such an action would set a precedent for other similar situations throughout Denver and that the number of such similar requests in the future would become unmanageable. However, this negative reaction did not stop the parents. They continued to pressure and use the local media to bring pressure upon the district. Thus it was finally determed that the operation of a special shuttle bus service was the only answer to the problem which would be acceptable to the local community.

Within one-and-a-half months of the first day of school, the shuttle bus was in operation. It is estimated that the service costs the school district approximately $30,000 per year to operate. It consists of one bus which picks up the children at Birch and 34th Avenue at 8:45 AM and delivers them to the school. In the afternoon, the bus leaves the school at 3:30 and delivers the students to the same point. Riding the bus is not mandatory; however, it does seem to be fairly successful. Approximately 70 students per day utilize the bus from the area north of 32nd and east of Colorado. A few students are still brought to the school by their parents and a few still walk across the arterials. There have been no incidents of major accidents involving the school children crossing either 32nd or Colorado.

The mid-block, pedestrian-actuated signalized crossing on 32nd Avenue just east of Jackson Street had been installed in previous years. It resulted from the need for many children from the Clayton Home just to the north to cross 32nd Avenue, a number of whom used to attend Barrett School.

IV. SUMMARY AND RECOMMENDATIONS

A. Lessons Learned

Probably the most important lesson learned from this particular situation is that the planning of school boundaries, in this case necessary to meet the integration policy established by the courts, cannot be determined from a distance and based solely on socio-economic input. If the computer program utilized to develop the boundaries in Denver had included as a major element the principal roadway sytem, the boundary for Barrett Elementary would not have been located as it was. The impact of this boundary was pointed out by the principal immediately after it was established, but it was determined that the effort involved in adjusting all of the boundaries to reflect the impact of the streets would be very cumbersome. In addition, the available schedule did not alow such revisions to be made.

The other major lesson that has been learned by the community is that if they organized themselves properly and enlist the support of the school principal and other local officials, they can make their opinions known to the decision makers. In addition, they have learned that use of the media (both TV and press) can be very effective in reaching the appropriate individuals. They have learned that cooperation from the city has been very good if they are truly committed to their concerns and their requests are reasonable. The school district traffic safety coordinator is continuously in contact with the city traffic engineering department to discuss issues. In addition, each principal has the authority to contact directly the city traffic engineering staff to discuss any immediate problems he may have. Response to such contacts has been very prompt and supportive.

B. Suggestions

It has been suggested that in any future busing considerations, although it is proper for the court to set the guidelines, the actual establishment of the busing boundaries should be conducted by the school district and other local personnel. Criteria regarding the safety of children must be considered in this analysis.

CHRONOLOGY -- BARRETT ELEMENTARY SCHOOL

1960	School is constructed and occupied.
1974	Just prior to the school term, the finalized plan for new school boundaries in accordance with the U.S. District Court ruling on integration is presented. First day of school, parents begin to complain about students having to cross Colorado Boulevard and/or 32nd Avenue. Meetings with school district and city staff are held. The media becomes involved. Within one-and-one-half months, a special shuttle bus is operating to transport children across these busy streets.

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case study background data

school

Moore Elementary School
846 Corona Street
Denver, Colorado 80218

K-6, 650 students
1889 -- older building
1909 -- newer building
Both buildings are two-story brick with wood frame, openable windows.
The two buildings are connected via a walkway on the second level.

highway

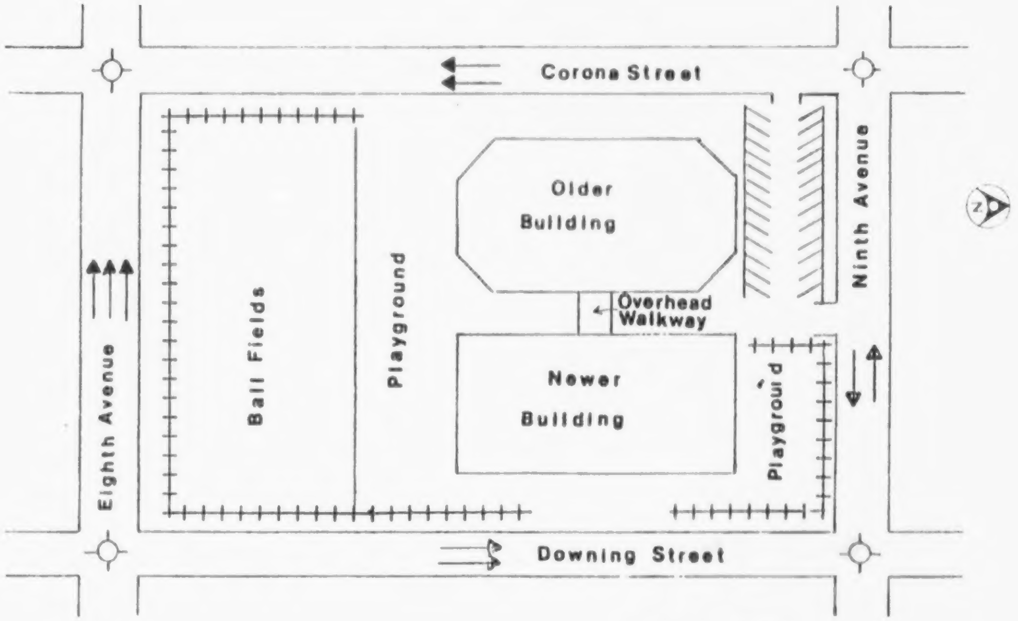
8th Avenue
Corona Street
Downing Street

8th Avenue
3-lane, one-way arterial (WB)
At grade
ADT: 16,900 vpd (1976)
Speed limit: 30 mph
Special 20 mph @ school

Corona Street
2-lane, one-way feeder (SB)
At grade
ADT: 6,550 vpd (1976)
Speed limit: 30 mph
Special 20 mph @ school

Downing Street
2-lane, one-way feeder (NB)
At grade
ADT: 7,350 vpd (1976)
Speed limit: 30 mph
Special 20 mph @ school

situational diagram



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I. SITUATIONAL CONTEXT

A. Highway

Moore Elementary School is situated in one of the "worst traffic conditions possible" according to respondents, with busy at-grade arterial streets on all sides of its property. The most heavily traveled of these streets is 8th Avenue, which is a three-lane, one-way arterial in the westbound direction feeding into downtown Denver and which is located along the south boundary of the school property. It currently carries about 16,900 vehicles per day (vpd). The posted speed limit is 30 mph.

On the east and west sides of the school are Downing Street and Corona Street, respectively, which operate as a one-way couplet. Both streets provide two lanes of travel and have posted speed limits of 30 mph. Downing operates in the northbound direction and carries about 7,350 vpd, while Corona carries approximately 6,550 vpd in the southbound direction.

On the remaining side, the north side, is 9th Avenue. This street is the only two-way street adjacent to the school, with one lane in each direction. The posted speed limit is 25 mph.

All four of the adjacent intersections are signalized. Although there are no special pedestrian signal indications at these intersections, all of the signals are controlled by pedestrian-actuated buttons.

B. School

Moore Elementary School is a public school in the Denver Public School District. It currently houses grades one through six and has an enrollment of approximately 650 students.

The school has historically served an influential area of Denver referred to as Capitol Hill as well as areas representing primarily poor families. Its service area basically extends from the eastern boundary of Cheeseman Park, which is about eight blocks east of the school, to Cherokee Street located near downtown Denver about thirteen blocks west of the school. The service area is also generally bounded by 1st Avenue on the south and 13th Avenue on the north. In addition, about 180 students are bused to the school from the Lincoln Housing Project, which is located on the southwest edge of the downtown area. The bus ride to the school takes about eight to ten minutes.

The original portion of the school, which is situated on the northwestern quadrant of the property, was constructed in 1889. In 1909, the school was enlarged by the construction of another building in the northeastern quadrant of the block. The two buildings are connected by an overhead walkway at the second story. Both buildings are two-story brick structures with large, wood-framed, openable windows. Neither building is air conditioned. The main entrances to the buildings open toward 9th Avenue.

C. Proximity Relationships

The school buildings lie closest to the one-way couplet streets, Downing and Corona. The older building is situated about 35 feet from the edge of Corona, while the newer building is about 45 feet from the edge of Downing Street. The front of the buildings is approximately 70 feet from 9th Avenue; a parking lot with its entrance on 9th Avenue and its exit on Corona utilizes this space in front of the older building, while a small playground area is located in front of the newer building.

Eighth Avenue, the busiest of the surrounding streets, is also the farthest distance from the buildings. The edge of the street is nearly 220 feet south of the buildings and is separated from the school by the playground and ball fields. The terrain is relatively flat and, thus, all streets are at-grade with the school.

Downing Street, Corona Street, and 8th Avenue are principally lined with residences. Ninth Avenue, however, has been developed with commercial properties in the vicinity of the school. Directly north of the school across 9th Avenue is a small neighborhood shopping center with a popular supermarket.

II. IMPACTS

The most significant impact that the school experiences due to its location is that of hazardous conditions for pedestrian (school children) access to the school. According to the school staff and the parents, the heavy volumes of traffic on the surrounding one-way streets create very unsafe conditions for elementary school children who have to walk to school. There is strong disagreement among the different groups regarding the one-way street system. Neighborhood groups state that the one-way streets encourage considerably more traffic to travel through their neighborhood than would do so otherwise. They furthermore indicate that they believe one-way streets also encourage faster speeds. The combination of heavier traffic and higher speeds causes them to be greatly concerned about the safety of their children. On the other hand, traffic engineers point to the fact that the one-way streets are the most efficient way to handle the heavy flows of traffic to and from the downtown. They also point out that the one-way system probably (although not yet substantiated) improves crossing safety at intersections because it reduces the directions of travel and the number of turning movements of which pedestrians must be aware.

Although pedestrian safety is the impact of most serious concern at Moore Elementary School, noise generated by the traffic was also noted as an adverse impact. Because the school is not air conditioned, windows are opened during warm weather, thereby allowing the noise to permeate the classrooms. Although the respondents did not indicate that the general noise level throughout the day was a significant impact, it was noted that frequent emergency vehicle travel on these streets was a major distraction to classroom activity.

III. MITIGATION MEASURES

A number of measures have been implemented in an attempt to improve and ensure the safety of school children pedestrians. In the words of the school principal there is a "constant vigilance for safety" among the staff. The children are continuously being reminded of the hazards of traffic and the staff is constantly observing traffic safety on an informal basis.

In addition to these passive measures, however, the various active measures which have been taken are more evident. For example, the Denver Traffic Engineering Department provides six crossing guards at Moore school crossings. The first two of these were located in 1972 at the intersections of 8th/Downing and 8th/Corona, immediately adjacent to the school. In March 1973, a child was hit by a motorist while being unloaded from a school bus at the intersection of 9th/Downing. This incident, along with a growing concern over the one-way street system, prompted the neighborhood parents group to begin organized pressure for more crossing guards. In response, guards were approved for funding and were stationed at the intersections of 9th/Downing and 9th/Corona. In 1975, due to an increase in the number of students crossing Sixth Avenue, which is a heavily travelled one-way arterial two blocks south of the school, crossing guards were also implemented at the intersections of 6th/Downing and 6th/Corona. In addition to being on duty during the morning arrival and the afternoon departure hours, the guards also serve during the mid-day period because the school operates a split-day kindergarten. In the eyes of all persons involved, the crossing guard program is considered to be a success; there have been no accidents at the school since the incident in 1973. School staff members are not used as crossing guards because of concern for the legal liabilities involved.

In addition to the crossing guards, the standard, and some special, traffic control devices have been used in the vicinity of the school. All crosswalks used by the students are designated with appropriate pavement markings. Standard School Advance and/or School Crossing signs (as identified in the Manual on Uniform Traffic Control Devices) are in place on the approaches to the school crossings. Furthermore, on the one-way streets approaching the school, such signs are placed on both sides of the street.

These sign installations on the one-way streets are also supplemented with two flashing yellow signals and signs reading "20 mph When Flashing." The signals and the speed limit signs are mounted on the same pole as the school warning signs and are implemented on both sides of the streets at the following locations:

- Downing between 7th and 8th
- Corona between 9th and 10th
- 8th east of Downing

The flashers were installed under an experimental program by the Denver Traffic Department; however, the results of the study did not indicate a justification of the expense involved in installing such signals. In addition, the Parent-Teacher-Student Association, which is an extremely active and well-informed group, has taken it upon themselves in the past to check speed limits through this school zone. The results of their surveys indicate that the speed limits, even with the flashing signals, are exceeded regularly.

Several other types of signs have also been installed for pedestrian safety purposes. "No Turn on Red When Children Are Present" signs are located at all of the intersections adjacent to the school property. These signs are frequently requested by parent groups and are installed by Traffic Engineering to help to minimize auto-pedestrian conflicts due to turning movements. There are, however, some doubts among traffic engineers about the usefulness of these because the only crosswalks which should be occupied when the signal indication is red to the motorist are those walks directly in front of his vehicle. Thus, visibility should not be a problem. It is, therefore, believed that these signs may only add to the visual clutter at intersections. Critics will respond, however, that at least the signs provide additional warning to motorists that there is a school crosswalk located at the intersection.

A side door to the newer building is located on the side facing Downing Street. In an attempt to discourage students who use this door from crossing Downing at that mid-block point, a sign reading "No Pedestrian Crossing/Use Crosswalk" with an arrow pointing to the crosswalks at either end of the block has been installed. It faces the school and is mounted at a height of about three feet to enhance observation of the sign by the young children.

The PTSA group is vehemently opposed to the one-way street system and has been very active in the crusade to revert the system back to a two-way operation. Analyzing the travel speeds on these streets is an example of their involvement. The group has written numerous letters to local decision-makers related to the one-way system and has provided testimony to the City Council on this matter. Efforts to date have not been successful.

An administrative operations measure taken by the school principal several years ago represents a somewhat unique mitigation measure related to pedestrian safety. The school hours of operation were shifted to one-half hour earlier in the day in order to minimize conflicts of school pedestrians with the heavy traffic associated with the late afternoon commuter traffic build-up. Although such shifts in hours are more limited now by the logistics of shared school bus usage, shifts within a reasonable range cam be implemented and can be beneficial in reducing this impact.

Several years ago, the School District had plans to raze the existing building and to construct a new, low building on the south side of the property. This plan would have located the school closer to 8th Avenue, but this would have been necessary in order to maintain operation of the existing school while the new one was being built. Furthermore, the new school could have been designed to reduce the effects of its proximity to 8th Avenue.

However, because the school represents a unique style of architecture and because it is rich in history, the community campaigned to have the school designated as an historic landmark. As a result, in 1975, Moore Elementary School was designated as City and County of Denver Landmark No.77 by the Landmark Preservation Commission. The community is still very active in attempts to raise funds for the restoration of the building. A large committee with many subcommittees representing community members and school staff members is working on this program.

The School District has allocated $450,000 to remodel the school, most of which is directed toward improvement of the functional areas within the school. Some of these improvements should improve noise conditions; for example, ceiling panels and carpet treatment in the classrooms, and accoustical tile in the auditorium. However, it is expected that these will reduce mostly noise generated by indoor activity rather than traffic-related noise. No specific noise analyses have been conducted in preparation for this remodeling effort. Air conditioning is not included in the plans, so the windows will continue to be opened. Some monies are being allocated to some landscaping along the play areas, but it is not expected to adequately buffer the noise.

IV. SUMMARY AND RECOMMENDATIONS

A. Lessons Learned

School crossing guards (adults) can be very beneficial at elementary school crosswalks along busy streets.

Special school speed zones, even with flashing signals, experience excessive travel speeds.

A new school building is not always considered to be desirable by the surrounding community. In this particular case, remodeling the historic building was deemed more desirable than a new building even though the remodeling would not alleviate certain impacts such as noise.

A slight shift in the hours of operation at a school with consideration given to peak traffic hours can reduce the potential for conflicts between school-age pedestrians and heavy auto traffic.

B. Suggestions

Further research should be conducted into the safety implications of one-way streets as related to school operations.

School hours should be reviewed and established on an individual basis (rather than a district-wide basis) within the limitations of the restrictions caused by shared bus usage. This would allow for adjusting student arrivals and departures to avoid heavy traffic.

CHRONOLOGY -- MOORE ELEMENTARY SCHOOL

1889	First school building constructed.
1909	Second building constructed on site.
Mid 1950s	Streets converted to one-way.
1972	Crossing guards assigned to intersections of 8th/Downing and 8th/Corona.
1973	Accident involving school child occurred at intersection of 9th/Downing. Due to pressure from the community, crossing guards were assigned to intersection of 9th/Downing and 95th/Corona.
1975	Crossing guards assigned to intersections of 6th/Downing and 6th/Corona. School hours are revised to avoid conflict with late afternoon heavy build-up of traffic. Plans for new school are included in the School District's Six-Year Building Program. Community organizes and has building designated as City and County of Denver Historic Landmark. $450,000 are allocated by School District for interior remodeling.
Spring 1978	Most of the remodeling will be conducted, including ceiling panels and carpeting in the classrooms and acoustical tile in the auditorium.

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case study background data

school

Wyman Elementary School
1630 Williams Street
Denver, Colorado 80218

Pre-school to 6th grade
550 students
1975
Two-story brick structure
Enclosed windows, air conditioned
Interior layout centered around Instructional Materials Center

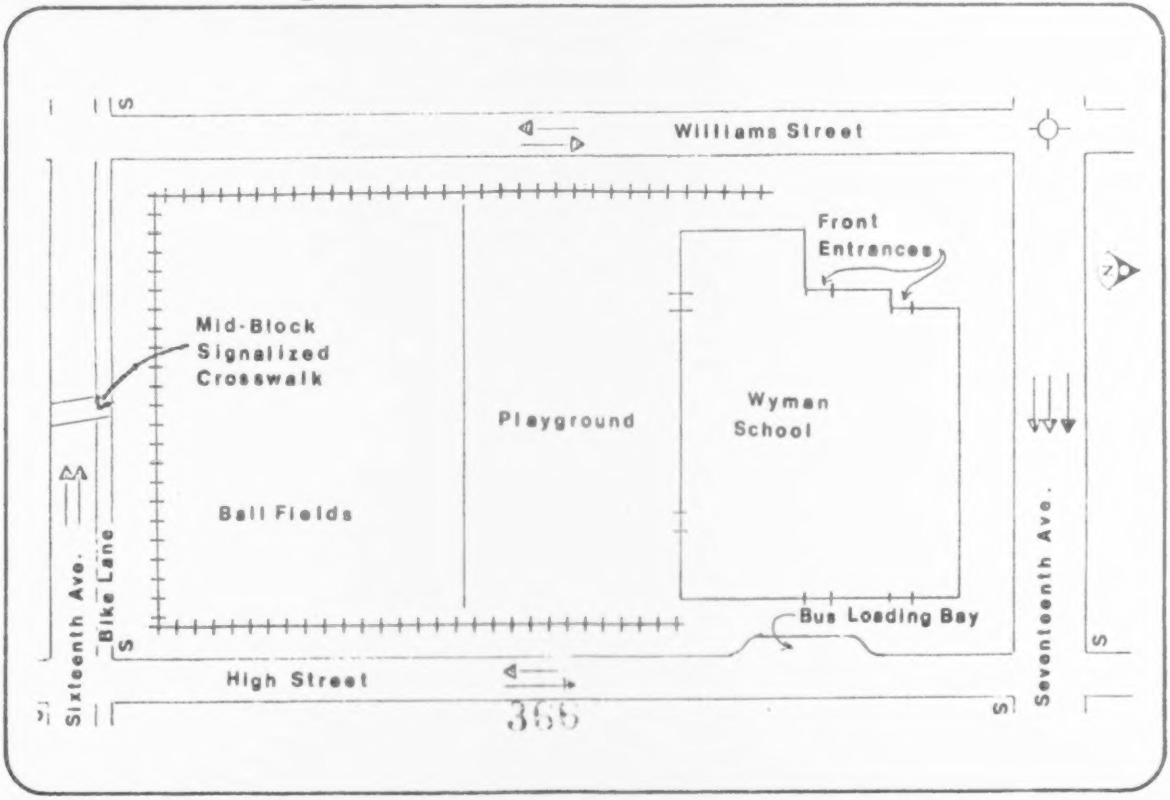
highway

16th Avenue
17th Avenue

17th Avenue
3-lane, one-way arterial (EB)
At grade
ADT: 12,800 vpd (1976)
Speed limit: 30 mph

16th Avenue
2-lane, one-way arterial (WB) with bike lane
At grade
ADT: 6,000 vpd (1976)
Speed limit: 30 mph

situational diagram



I. SITUATIONAL CONTEXT

A. Highway

The Wyman Elementary School property is bordered on the north and south sides by one-way streets which carry substantial volumes of traffic. The street which is most closely located to the school building is also the street which carries the heaviest traffic volumes adjacent to the school. This street, 17th Avenue, is located on the north side of the school and is a three-lane, one-way arterial carrying traffic eastbound away from the downtown. It carries about 12,800 vehicles per day and has a posted speed limit of 30 mph.

Adjacent to the school property on the south side is 16th Avenue, a two-lane westbound arterial which carries approximately 6,000 vehicles per day. In addition to the two travel lanes, the street cross-section includes a bicycle lane on the right-hand side. The speed limit on 16th Avenue is also 30 mph.

On the east and west sides of the school are streets which are less traveled. Williams Street on the west and High Street on the east are both two-way streets with one lane in each direction. No traffic counts have been recorded on these streets because the volumes are relatively insignificant. Speed limits on these streets are 25 mph.

Although 16th and 17th Avenues are the only streets with significant traffic immediately adjacent to the school, several other heavily traveled streets affect the school. One block south of the school lies Colfax Avenue, the major east-west arterial in Denver. Colfax provides three lanes of travel in each direction and carries about 24,400 vehicles per day. One block north of the school is 18th Avenue, which is a three-lane, one-way (westbound) arterial carrying approximately 15,000 vpd. Students walking to school must also cross these busy streets as well as 16th and 17th Avenues.

There are two traffic signal installations adjacent to the school. One such installation is located at the intersection of 17th/Williams. The other signal is situated on 16th Avenue at midblock between High and Williams. Students are encouraged to cross at these locations because pedestrian crosswalks are designated. The other intersections are STOP-sign controlled with 16th and 17th Avenues having the right-of-way.

B. School

Providing services to age groups ranging from pre-school to the sixth grade, Wyman Elementary School has a current enrollment of about 550 students. In the past, the enrollment has been as high as 650 students, although the school was not designed to comfortably house that many students. The school is part of the Denver Public School District.

Only about one half of the students come from the service area immediately surrounding the school. This area is generally bounded by York Street on the east (four blocks from the school), 13th Avenue on the south (three blocks south of the school and two blocks south of Colfax Avenue), Franklin Street on the west (two blocks from the school), and 19th Avenue on the north (two blocks north of the school). The other one half of the students are bused to the school from a number of areas throughout the city. The largest portion comes from the Stapleton Housing projects and represents children of low-income families. Other students are bused from a residential subdivision of upper-middle income families. However, because of its location and the large number of poor students bused to the school, Wyman is number two on the "percent of impaction" list of schools in the district--percentage of students from welfare families.

The original school building was constructed on the southwest corner of the block in 1891. It was a three-story, brick structure facing onto Williams Street with a playground area in the rear. However, in the early 1970's, it became apparent to the School District that the old building was losing its functional usefulness because of its age and antiquated style of design. Therefore, the property on the north side of the block was purchased to create an entire block on which a new school could be planned and constructed.

In 1975, the new school was completed on the northern portion of the block and the students moved from the old building in February. It is a two-story, brick structure with classrooms and other facilities centered around an open Instructional Materials Center, which has been forced into service as classrooms at times when conditions have been crowded. The building is completely air conditioned and the windows cannot be opened. All of the classrooms have windows, but most of the windows face toward the side streets, Williams and High. The main entrance to the school is located along Williams Street.

The large functional areas of the school--the gym and the auditorium/cafeteria--are situated in the southern end of the building. Adjacent to these facilities on the south is the paved playground area. The southernmost part of the block, where the old school used to stand, is now used for playfields. The school parking lot is located on a small parcel of property directly opposite the school across Williams Street.

C. Proximity Relationships

The building is located most closely to 17th Avenue; a distance of only about thirty feet separates the school from the edge of the street. The school is relatively close to the side streets, being 30 feet from High Street and about 45 feet at its closest point from Williams Street. With the playground and fields separating the school and 16th Avenue, the distance is greater than 300 feet. In the northwest corner of the property, the school is at an elevation several feet higher than the roadways. With this one minor exception, the school and the surrounding streets are basically at grade.

The surrounding neighborhood is primarily residential, but of varying types. Some is older single-family residential, some is comprised of houses which have been converted to a limited number of apartments, and there are also large apartment buildings in the area.

Across 17th Avenue from the school is a high-rise apartment building for the elderly. There is some commercial property along 17th Avenue in the vicinity of the school. Colfax Avenue, one block south of the school, is completely adjoined by commercial development. In addition, major hospital areas lie close to the school to the north and to the east.

II. IMPACTS

The most significant impact experienced both in the past and at present (even with the new school) related to the safety of school children in accessing the school. To some degree, the decree of forced integration and the resulting busing has helped to lessen this impact simply by decreasing the number of students who walk to school. However, one half of the students will walk and these students must cross at least one busy arterial to reach the school. The problem is further aggravated in the morning by the fact that the school serves breakfast to any students who are interested and, thus, the arrival times have two peaks rather than the typical one.

Several accidents have occurred in recent years, a fact which highlights the severity of this impact. In January of 1969, a child was struck by an auto on 17th Avenue as he attempted to cross the street from between parked cars and outside the designated crosswalks. About one year ago, a child was hit by an automobile when crossing Colfax Avenue. It is questionable that this accident could have been avoided by any means short of a grade separated crossing because the child was crossing with the signal. The other accident also occurred on Colfax Avenue and involved a school bus. As the bus was turning right off of Colfax to access the school, a bicyclist attempted to pass the bus on the right; the bus driver, who did not see the bicyclist, continued the right turn and the two vehicles collided. Although these accidents may not have been readily avoidable through implementable measures, they serve as a reminder that school operations in the vicinity of major traffic facilities must be closely considered when planning these operations.

The other impact, which has not been noted as significant in the new building, but which certainly was when the old building was in use, is noise related to the traffic on adjacent streets. At times in the past, the noise was disruptive to classroom instruction; this was particularly true of the relatively frequent emergency vehicles traveling to and from the nearby hospitals. Although the new school is situated much closer to the busiest street than was the old building, the noise impact is considerably less and is seldom even noted as a problem. This change in significance has resulted from numerous concepts in the school design which, although their primary purpose may or may not have been noise related, have reduced the level of noise experienced inside the classroom.

III. MITIGATING MEASURES

A number of measures have been taken in an attempt to improve pedestrian safety as much as possible. Many of these have been in place or in operation for a number of years; others have only been implemented since the integration program was begun.

The most prevalent of these measures is the assignment of crossing guards by the Denver Traffic Engineering Department to two locations traveled by Wyman students. Prior to integration, a guard was placed at the intersection of 17th/Williams to assist the high number of students who crossed there. With the redrawing of school boundaries under the integration plan, approximately fifty (50) students who resided south of Colfax Avenue began to attend Wyman. Following conversations between the school principal and the Traffic Safety Coordinator, it was decided to assign another guard to assist students crossing Colfax at Williams Street. Even with the guard at this location, the pre-school children from Warren Village south of Colfax are today brought to the school in a group monitored by an adult.

Traffic signals represent another safety measure which has been utilized to help improve the situation. When the pedestrian-auto accident occurred on 17th Avenue in 1969, the signal adjacent to the school was located on 17th Avenue at mig-block between Williams and High Streets. In the fall of 1969, at the urging of the Wyman School PTA and after careful consideration of the progression of the signal system in the area, the Traffic Engineering Department relocated this signal to the intersection of 17th/Williams where it would be located more directly on the students' path to the old school building. With the advent of the new boundaries in 1974, the school principal requested that Traffic Engineering investigate the possibility of installing signals at the intersections of Colfax/Williams and 16th/Williams. It was determined that a signal at Colfax/Williams would not only benefit the children but the traffic as well, and plans were begun for the installation. The signals are currently in place at that location and are augmented by the crossing guard mentioned earlier. However, the review indicated that relocation of the mid-block signal on 16th Avenue to the intersection of 16th/Williams would cause difficulties in the signal progression (thus, causing undue delays) and, therefore, was not implemented.

Traffic control signs have also been used to improve pedestrian safety. The standard yellow School Advance and School Crossing signs as designated in the Manual on Uniform Traffic Control Devices are in place on the approaches to school crosswalks.

The loading and unloading of buses have also been given special consideration in order to avoid safety problems. All such activity occurs on High Street in the rear of the school. This location was chosen because it presents the least potential for conflict of the buses and students with heavy auto traffic. When the new school was designed, the architects designed a special loading/unloading bay along High Street for the buses. This was not a site plan requirement of the Traffic Engineering Department, but was considered to be beneficial. However, the length of the bay is only sufficient for one bus to occupy the bay at any given time. Thus, the other buses continue to load/unload at curbside along High Street (the loading/unloading zones are properly signed). In addition, school staff is assigned the responsibility of monitoring all bus loading and unloading.

Although no noise monitoring or specific analyses were conducted in the planning and design of the new school, noise factors were considered on a relative basis by the architects. This is reflected in a number of design concepts used in the school. The first question which comes to mind is "Why was the school located at the north end of the property adjacent to the most heavily traveled of the four streets adjoining the property?" Several considerations led to this decision. First, such a location would allow the old school to continue to operate until the new school was ready for occupancy. Secondly, with this plan the playground area would have the southern exposure to the sun, which is beneficial in Denver in the winter. A third consideration, however, was that traffic on 17th Avenue is eastbound (out of downtown) and therefore peaks in the late afternoon. Sixteenth Avenue, on the other hand, peaks during the morning hours. Thus, because of the school schedule, there is less conflict associated with 17th Avenue than there would be with 16th Avenue.

The entire school is fitted with sealed windows and is air conditioned, which helps to keep out unwanted noise. Furthermore, the building wall adjacent to 17th Avenue has only small windows on the first floor and no windows on the second level. On the first floor along 17th Avenue, nearly all of the rooms are offices, which are not as noise-sensitive as classrooms. The Instructional Materials Center is located in the middle of the building and, thus, is buffered on all sides by classrooms and other space. With all of these design considerations, noise is no longer an impact or even a noticeable feature in the new school.

IV. SUMMARY AND RECOMMENDATIONS

A. Lessons Learned

It is extremely difficult to educate children not to jaywalk and some form of positive guidance to the children is essential, particularly on heavily traveled streets.

Through careful consideration of the interior layout of a school, the most noise-sensitive activities can be located in such a manner that they are buffered by other spaces without adversely affecting the functional flows throughout the building.

A separate Bus loacing/unloading bay can be beneficial, but must be designed to provide adequate space for the number of buses serving the school.

B. Suggestions

Adult crossing guards should be utilized at as many major streets crosswalks as possible.

All traffic control devices in the vicinity of schools should be reviewed on a regular basis to insur that they are adequately serving changing patterns of auto traffic and school children pedestrian flow.

The peaking characteristics of adjacent streets (particularly one-way streets) should be considered in school planning because this factor can sometimes be used to minimize conflicts of school operation and street operation.

CHRONOLOGY -- WYMAN ELEMENTARY SCHOOL

1891	Original school building constructed.
1969	Child is hit by auto while running from between parked cars on 17th Avenue. Although not school-related (occurred at night), accident caused PTA to urge for relocation of mid-block signal on 17th to the intersection of 17th/Williams. After careful consideration, signal is relocated.
Early 1970's	Old school is deemed to be functionally inadequate. Property on north portion of the block is purchased and planning for the new school begins.
1974	Court decrees a plan for school integration and school boundaries are changed. As a result, school crossing guard is assigned to intersection of Colfax/Williams. School requests consideration of signal installation at Colfax/Williams and signal relocation from mid-block on 16th to 16th/Williams. Signals installed at Colfax/Williams; relocation on 16th is rejected.
1975	New school is completed.

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school

Swansea Elementary School
4630 Columbine Street
Denver, Colorado

Grades 1 to 3
(Used to be K through 6)
600 students
Original school built in 1891.
Separate unit constructed in early 1950s.
New addition completed 1975.
One-story brick structure.
Enclosed windows, air conditioned.
"Open classroom" concept.

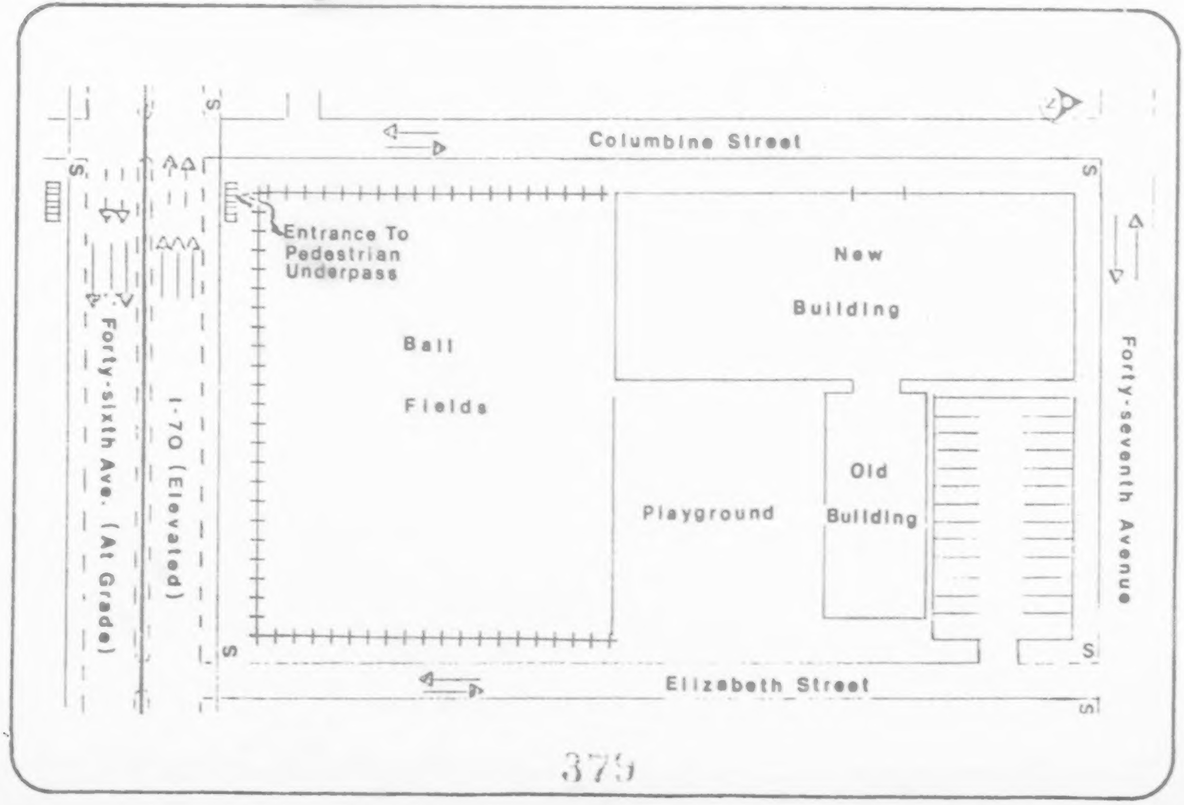
highway

Interstate 70
46th Avenue

Interstate 70
6-lane freeway
Elevated at height of approximately 20 feet.
ADT: 70,000 vpd (1976)
Speed limit: 55 mph

46th Avenue
4-lane divided arterial
At grade under I-70
ADT: 9,700 vpd (1976)
Heavy truck traffic
Speed limit: 30 mph

situational diagram



I. SITUATIONAL CONTEXT

A. Highway

Swansea Elementary School's relationship to adjacent streets and highways is somewhat unique in that the two major traffic facilities which affect the school are both located adjacent to and on the same side of the school property. Interstate Highway 70, the major east/west highway running through Denver, abuts the school property on the south side. I-70 was the forerunner of freeway construction in Denver and today is a six-lane freeway carrying about 70,000 vehicles per day in the vicinity of the school. Throughout the section in the area of the school, the freeway is constructed on a viaduct structure at an elevation of approximately twenty feet above the ground. The freeway was built in this manner so that itit would least interfere with existing adjacent land uses and with the at-grade street system.

Directly underneath I-70, also running east/west, lies 46th Avenue. It has two lanes of travel in each direction and has a raised concrete median which provides the space for columns to support the I-70 viaduct. Support columns are also located on either side of 46th Avenue; because of their minimal separation from the highway, these columns do cause some sight obstructions for the motorists observing roadside activity (pedestrian and vehicular) at intersections ahead. The speed limit is 30 mph and the street carries about 9,700 vehicles per day. Truck traffic is fairly heavy on 46th Avenue due to the industrial nature of the land uses along the street in the areas both east and west of the immediate school neighborhood.

The school property is also bounded by 47th Avenue on the north, Columbine Street on the west, and Elizabeth Street on the east, all of which are essentially residential streets serving only the immediate neighborhood. As such, traffic volumes on these streets are insignificant. They are all two-way streets with one lane in each direction. All intersections are STOP-sign controlled with 46th and 47th Avenues having the right-of-way, with one exception; all approaches to the intersection of 47th/Elizabeth are controlled by STOP signs.

B. School

Swansea Elementary School is in the Denver Public School District. Prior to the 1976/1977 school year, the school housed grades K through 6. However, since that time only students in grades 1 through 3 have attended Swansea. The current enrollment is approximately 600 students.

The school boundaries are approximated by Colorado Boulevard on the east (about 3/4 mile east of the school), the Denver Union Stockyards on the west (approximately 1/2 mile west of the school), 43rd Avenue to the south, and 52nd Avenue on the north. About one-half of the students come from within this area. The remainder of the students are bused from an upper-middle income residential area in southeast Denver. Seven buses are necessary to transport these students.

The original school, built in 1891, was located on the southeast corner of the property and was a two-story brick structure. In the early 1950s, the school district realized that the school was overcrowded and antiquated. Thus, it constructed the primary unit which comprises the eastern wing of the existing school. It is a single-story, brick building housing classrooms only. It is apparent that the district foresaw the ultimate need to totally replace the old building because this unit was designed to allow for a second floor to be added when necessary. With its overcrowdedness relieved by this auxiliary building, the school continued to operate for a number of years in two buildings.

In the early 1970s, planning began for the new addition to the school to replace the old building. An Advisory Committee was established to include not only school officials but also the community in the planning and design of the school. In 1975, the new school was completed as an addition on the west side of the primary unit. It, too, is a one-story brick structure; when this addition (which is the main portion of the school) was constructed, air conditioning was installed in both sections of the school. The new section is designed for the "open classroom" concept and most of the classrooms are on the northern side of the building. Less noise sensitive areas are located in the southern portion of the school, including the cafeteria, auditorium, and gymnasium.

C. Proximity Relationships

With the construction of the new school on the northern end of the property, the proximity relationships (and thus some impacts) have changed considerably. Whereas the school used to be practically abutting the interstate highway, the new school is separated from the highway by the playing fields--a distance of approximately 250 feet. The building is relatively close to the other streets bordering the property (less than 25 feet in all cases), but this presents no problems due to the nature of these streets.

An interesting feature of the proximity of the school to 46th Avenue is a pedestrian underpass under 46th Avenue on the east side of Columbine Street. This underpass was constructed for the use of school children as well as neighborhood residents walking to and from the supermarket south of 46th.

The neighborhoood immediately surrounding the school is principally single-family residential in nature and is comprised mostly of Spanish-speaking residents. Outside of the immediate neighborhood in the east and west directions, the land use is predominantly industrial.

II. IMPACTS

Two basic categories of impacts, pedestrian safety and pollution, have been experienced by the school. The pedestrian safety impacts have been associated primarily, although not only, with 46th Avenue; on the other hand, the pollution impacts have been related specifically to I-70. Furthermore, the pollution impacts have been greatly reduced in magnitude by the construction of the new school.

The pedestrian safety impact stems primarily from the need for students to cross 46th Avenue, which not only carries heavy volumes of traffic with a high percentage of truck traffic, but also has sight distance obstructions. This has historically been a concern of the parents for several reasons. First, neither of the intersections on 46th immediately adjacent to the school is signalized. Secondly, although the pedestrian underpass is avilable at 46th/Columbine, the underpass has in the past been.difficult to maintain and therefore has presented an image of being unsafe and unsanitary. It should be noted that although safety has been a concern, there has only been one accident involving a student in the last ten years. Furthermore, this accident involved an educationally retarded child who ran onto the street and into a passing vehicle; thus, without physical restrictions such as fending or other barriers, this accident may have been unpreventable.

Another aspect of pedestrian safety is related to the elevated section of I-70. Because the elevated section of freeway is directly above 46th Avenue and its intersections, water and slush being splashed over the edge of the freeway onto the sidewalks below. In addition, much of this matter was falling onto the steps leading to the pedestrian underpass and freezing, thus causing a hazardous condition for users of the underpass.

The pollution impacts included both noise and air pollution. When the school operated in the old building, the second story was nearly the same height as the freeway; additionally, the building was situated very close to the elevated highway. Thus, when the windows were open, the classrooms (especially on the upper floor) experienced severe noise and air pollution impacts. These impacts made classroom instruction extremely difficult at times. However, if the windows were closed during certain times of the year, the lack of ventilation was equally distracting. According to the principal, the students adjusted to the noise and air pollution impacts more readily than did the staff. It was also observed (although measured in no quantifiable manner) that the staff was more tired at the end of the day when they were battling these impacts. These same impacts have not been noted as significant since the construction of the new building.

III. MITIGATION MEASURES

The standard signs and markings have been installed at all designated crosswalks to help insure pedestrian safety. These include solid white lines marking both edges of the crosswalks and School Advance and School Crossing signs as recommended in the Manual on Uniorm Traffic Control Devices. These were installed as part of the Traffic Engineering Department's program to provide proper signing and marking of school crossings.

Another measure managed by the City's Traffic Engineering Department is the assignment of an adult crossing guard at the intersection of 46th/Clayton, several blocks east of the school. This intersection is guarded instead of an intersection closer to the school because it is signalized and the Department's policy is to place guards only at signalized intersections. This policy is in line with the concept that the guards should not control or direct traffic, but instead should monitor and control the children. Because this intersection is signalized and guarded, children are encouraged to use this route on the way to school; however, for some children it is out of the way and they cannot be pursuaded to use it. Last year, for this reason, assignments were made from the school staff to monitor pedestrian movement at the intersections of 46th/Elizabeth and 46th/Columbine.

The pedestrian underpass was constructed at 46th/Columbine at about the time the interstate highway was built in order to provide safe passage under 46th Avenue for students and other neighborhood pedestrians.

It was not noted that any particular group or agency was the primary force behind the underpass, but instead a general concern for safety prompted it. The underpass, however, did not solve the problem. Maintenance became a problem; dirt and debris collected in the tunnel, graffiti covered the walls, and lights were constantly being broken. Additionally, it became unsafe as kids and neighborhood transients would "hang out" in the underpass. Thus, children began to avoid the underpass and would cross 46th Avenue on the surface.

This caused concern among the parents and the school staff, who then brought the issue to the Traffic Engineering Department. The Department developed plans to fence and gate the entrances to the underpass. In order to lessen the problem of dirt and debris dropping into the underpass, the plans also included roofing the entrances. The plans were taken to the City-School Coordinating Commission and to the City Council, who jointly provided about $8,000 to fund the project. The work was completed at a cost of approximately $6,300, leaving about $1,700 for other improvements. It is hoped that, with some additional money, these funds can be used to improve the lighting system in the underpass.

When the project was completed about one year ago, another issue regarding this mitigation measure arose. The newly constructed gates would not be effective unless they were locked during those hours in which the underpass was not in use by the children. For the sake of convenience, it seemed logical that someone on the school staff should be responsible for opening the gates in the morning and closing them in the afternoon. The custodians were selected for this duty, but balked because of concerns about the legal liability associated with the responsibility. After numerous discussions between city and school district attorneys, it was decided that no liability would be involved with the assignment. Thus, the school custodians now have the responsibility and the gates are locked from late afternoon until early morning. This effort has resulted in a much cleaner and better maintained tunnel, thereby enhancing its image and increasing its attractiveness for use.

Prior to the fencing and covering of the underpass entrances, the underpass, along with the sidewalk along 46th and particularly the sidewalks at the intersection of 46th/Elizabeth, was seriously affected by another problem -- the splashing of water and slush from the elevated freeway. About five years ago, the PTA with the help of school officials brought tis problem to the attention of the Colorado Department of Highways. A series of meetings in which the City Traffic Engineering Department was also involved was held to discuss this matter. The result was a decision for CDH to install splash panels on the edge of the elevated freeway in order to keep water and slush from being splashed over the side. Such panels were installed in the vicinity of the intersections of 46th/Elizabeth and 46th/Columbine.

The pollution impacts have been greatly mitigated by the design of the new school. Although there were no specific noise or air pollution analyses conducted in the development of the school plans and although few features were included for the sole purpose of mitigating these pollution impacts, certain features have been helpful in alleviating or lessening the magnitude of such impacts. For example, although the primary purpose of constructing the school on the north end of the property was to be able to continue operation of the old building during construction, it also had the very beneficial impact of providing the greatest possible separation between the school and the freeway. Likewise, although the gymnasium, cafeteria and auditorium were primarily positioned on the south side of the building in order to be adjacent to the playground area, such positioning also serves as a buffer between the more sensitive classrooms and the highway. The air conditioning of the entire building has similarly helped the learning environment because the windows no longer need to be opened. The new school was designed as only a one-story building; thus, there is now a vertical separation as well as a horizontal separation between the school and the highway. All of these features have combined to reduce the pollution impacts (both noise and air) to a level which is no longer perceived as significant.

IV. SUMMARY AND RECOMMENDATIONS

A. Lessons Learned

Consideration of noise and air pollution impacts on a qualitative basis alone can be helpful in planning a new school.

Although certain design features may not have a primary purpose of mitigating air or noise impacts, if properly considered they can have a very beneficial secondary purpose in this regard.

Pedestrain underpasses can often cause difficult maintenance problems, which in turn create an unattractive atmosphere. When this occurs, children become reluctant to use the facility and opt to cross the street on the surface. Covering and providing gates at the entrances to an underpass can be very helpful in keeping the facility clear of debris and in restricting its use to its intended purpose.

The school administration believes that the children adapted to the air and noise pollution more readily than did the school staff.

B. Suggestions

Pedestrian overpasses should be considered instead of underpasses whenever feasible due to the factors of cleanliness and safety.

When an underpass has been constructed primarily to serve school children, it should be restricted to use only during school hours.

Further research should be conducted in the effects of air and noise pollution on school staffs.

CHRONOLOGY -- SWANSEA ELEMENTARY SCHOOL

1981	Original school constructed.
Early 1950s	Additional building of classrooms constructed on north portion of property to help relieve crowded conditions in the old building.
1963	Interstate 70 constructed through the area on viaduct structure to minimize impact on adjacent land uses and the surface street system.
Early 1970s	PTA and school officials complain to Colorado Department of Highways that water and slush is being splashed over the side of the elevated freeway and is causing hazardous pedestrian conditions below. Splash panels installed on side of I-70 in vicinity of intersections at 46th/Columbine and 46th/Elizabeth.
1975	New school completed as addition to unit built in 1950s.
1976	The entrances to the underpass are covered and enclosed by chain-link fence and gates which are kept locked during non-school hours. This plan was developed by the Traffic Engineering Department and was jointly funded by the City-School Coordinating Commission and the City Council.

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case study background data

school

St. Thomas Moore
Arlington, Virginia
Diocese of Arlington

Parochial, Grades K-8

521 Students

1940 Constructed

Brick construction, no central air conditioning

Campus is level, with the exception of SW corner, which drops sharply from Church to the intersection of N. Thomas and College Lane.

highway

Route 50

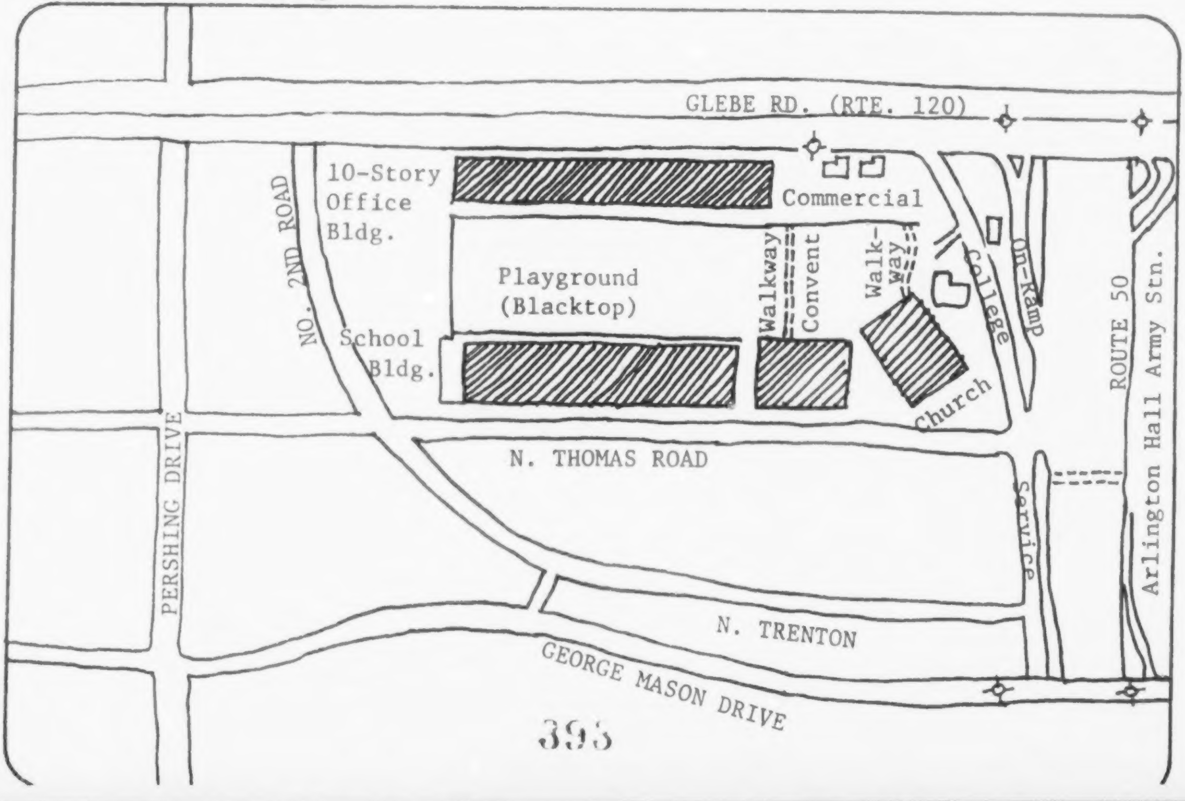
4 lane divided arterial, presently being widened to six lanes, projected completion August 1977.

	Route 50	Route 120
ADT:	44,000 present 55,000 DY	25,000 present 32,000 DY
Average Speed	35	30

Route 50 is depressed, straight alignment. Route 120 is at grade with adjacent development.

Heavy commute traffic on Route 50. While under construction, traffic is diverted to service roads.

situational diagram



I. SITUATIONAL CONTEXT

A. Highway

Route 50, also known as Arlington Boulevard, passes approximately 500 feet to the south of the campus of St. Thomas Moore School. It is a four-lane divided highway, and the section within the immediate vicinity of the school is now under construction for widening to six lanes. Perpendicular to Route 50 is N. Thomas Road, a three-lane (one-sided parking) collector street bordering the length of the campus. Short of its junction with Route 50, N. Thomas Road intersects with a two-lane, one-way service road, roughly paralleling the state highway. From the point of this intersection, westbound Route 50 traffic is currently being diverted to the service road to facilitate construction activities. The service road is congested, and in the absence of a stoplight at the intersection with N. Thomas Road, a westbound turn from N. Thomas onto the service road is dependent on the rare break in the highway traffic. The service road extended east of N. Thomas Road becomes College Lane, which intersects with Glebe Road (Route 120), an older four-lane arterial to the east of the campus, paralleling N. Thomas. The intersection of College Lane with Glebe Road occurs just before the overpass of Glebe across Route 50. This overpass, and the intersections with on-ramps at either end, are congested, although regulated with stoplights.

The highway was constructed as a four-lane divided route. The construction of the improvements to the section adjacent to the school was begun in May 1976. Completion of this section is projected for August-September 1977.

The Virginia Department of Highways and Transportation is responsible for the construction of improvements to Route 50, under the supervision of the Fairfax Residency office. Some maintenance functions for Route 50 are shared with the Arlington County Board.

B. School

St. Thomas Moore School is a parochial institution offering non-resident instruction for grades K-8. Current enrollment is 521 pupils. The principal estimates that the original structure was completed around 1940. There have been several additions to the school building, including a number of classrooms, an auditorium, a learning center, and a faculty lounge, the latter two within the past five years. In addition to the school building, there is an adjacent convent, which offers residential quarters; a church; and a large blacktop area, divided into playground and parking areas. As indicated on the situational diagram, the blacktop behind the school extends to the strip of commercial development bordering Glebe Road. The entire campus area is roughly four acres.

All campus facilities are of masonry (brick exterior) construction. None are air-conditioned, with the exception of a window unit in the office. The school building is two stories in height; the convent is three stories. The school building is utilized from September through May only; no usage is made during the summer months. School hours are 8:45-3:30. The building is used occasionally at off-school hours for meetings of the Parent-Teacher Organization.

C. Proximity Relationships

The topography of the area is characterized by gently rolling hills.

Route 50 is depressed, and Route 120 intersects it as an overpass. The campus is level and at grade with Route 120. The school building and the convent comprise a block-long unit set back approximately 30 feet from N. Thomas Road. Because of the sharp drop from the location of the church to the intersection of N. Thomas and the service road, and the depression of Route 50, the church is approximately 25 feet higher than the highway.

Housing types in the surrounding residential area are predominantly two-story, older apartment units.

Other development in the area includes a strip of commercial development bordering Glebe Road, including a high-rise office building; and a permanent Army installation, Arlington Hall Station, on the other side of Route 50, several hundred feet west of the school's location. The post was established in 1942.

Route 50 is accessible by means of on-ramps at the intersection with Route 120, or the parallel feeder, George Mason Drive, several hundred yards west. There are traffic control lights at either end of both overpasses. There are stop signs for College Lane and North Thomas where they intersect the westbound service lane. There is also a flashing speed limit sign on Glebe Road, indicating a school zone during appropriate hours.

The location of the flashing light terminates a pedestrian walkway which crosses the blacktop, from the rear of the school. Walking students use this approach exclusively. This walkway is variously painted, bordered by cement islands, and fenced along one edge. From the school, the homeward walking route is across the blacktop out to Glebe Road, and south along Glebe Road and the overpass. The children are escorted across the overpass by an Arlington County signal guard. Several hundred yards beyond, the children turn westward onto a residential street which deadends at a gate to the Army property. Here an Army staff-person (M.P.) is provided to escort the children across the post and through a tunnel underneath George Mason Drive. They emerge from here to their residential area. The principal estimates that approximately 25 percent of the children walk to school.

The remaining students utilize school buses, which line up on N. Thomas Road in the school bus zone. The bus route follows N. Thomas and residential streets to Glebe Road.

Automobiles of teachers and staff enter the campus from College Lane and park in the blacktop area.

II. IMPACTS -- ON SCHOOL AND HIGHWAY

Route 50 is an exclusively state-funded highway project. The laws of the State of Virginia do not mandate vigorous environmental review on state projects, and the minimal overview analysis of the impacts of expansion did not yield any remarkable findings.

The ongoing construction activities in connection with the widening of the Beltway have impacted the school mainly as a safety hazard to walking students. There are also occasional banging noises, but the principal did not find them disruptive. Similarly the traffic noise from Route 50 is audible from the church entrance, but the principal does not find it bothersome in any way. No impacts of the school on the highway were identified.

Before construction of the improvements was undertaken, students walked down N. Thomas Road and across the service road to utilize a pedestrian tunnel under Route 50. Emerging from the tunnel, they entered the main gate to Arlington Hall Station and were escorted across the post by an Army M.P.

The issue of interference and hazard to the pedestrian route of students was identified by representatives of the Army Station. They reported that the plan to expand Route 50 had been generally known to them for several years when the Virginia Department of Highways and Transportation notified them in early Spring 1976 that construction would begin in a few months' time. The Army was concerned about the impact of construction activities on their front gate, which opens on Route 50, and requested a conference which was attended by state and county traffic engineers and the construction contractor. A

Colonel on the base recognized the implications for walking students, and instructed the Safety Officer to investigate the impact. The Safety Officer engaged in preliminary examination with the traffic engineers of the highway department, and discovered that the service roads would be utilized as diversion routes, and therefore pose a safety hazard to crossing students. The Colonel then authorized the Safety Officer to pursue investigation of a satisfactory solution.

The identification of the impact reflected both a personal concern on the part of several individual Army staff; and a sense of responsibility on the part of the Station to fulfill a "good neighbor" role in the community. At this point, it was the understanding of the Safety Officer that neither the school principal nor the County traffic police had access to the construction plans. The Army Colonel characterized the role of the Army as a catalyst to the problem-solving process. It was he who contacted the school principal to apprise her of the anticipated situation.

III. MITIGATION MEASURES

A. Measures Proposed

During this period, various safety measures were investigated by the Army Safety Officer in consultation with the traffic and construction engineers of the Highway Department, and Safety Officers of the Arlington County Police Department. Initially considered were a crosswalk, traffic light, or other traffic control device for the service road, presumably at either end of the tunnel entrance. It was decided that these were not feasible because of resultant congestion in the service road traffic.

Use of the Glebe Road overpass appeared to be the best solution. However, at that time there was no entrance to the post which was convenient and safe for the children, since the front gate on Route 50 was to be impacted by construction activities. The Safety Officer recommended that the Army cut a gate in the continuous fence to allow entry from one of the residential streets intersecting with Glebe Road. The Army also sought a commitment from the Highway Department to enclose the overpass, and from the Police to provide safety guards.

B. Measures Implemented

This solution was suggested to the school principal in early summer of 1976. She consulted with parents of affected children for their preference between the proposed rerouting of the children or the use of buses (implying the acquisition of additional service). The parents and the principal determined that the rerouting was preferable. As of September 1976, the children were instructed to take the new route. By that time the Army had installed the gate, giving access to the residential street, and had allocated escort staff; a snow fence was placed on the overpass by the State Highway Department, and the County provided signal guards and the flashing school zone speed limit light.

The principal feels that this solution has proved entirely satisfactory. The Colonel suggested that a cage would have been preferable to the snow fence, for safety reasons, but no incidents have resulted for lack of it. Both the Army officials and the school principal characterized the participation of all parties as very cooperative and effective.

C. Future Needs

There are no proposals under consideration in connection with the completion of the construction activities. The Army Safety Officer suggested that the accessibility of the tunnel was as yet problematical. A possible route would take the students west on the service road, where there is a sidewalk part of the way, and across Route 50 via the George Mason overpass, which is equipped with a sidewalk and cage.

IV. SUMMARY AND RECOMMENDATIONS

The most remarkable aspect of this case is that neither the highway department nor the school anticipated the disruption that would be caused by the construction activities to the children's walking route. More generally, there was apparently no communication between the highway department and the school as to the planned construction. Several factors contributed to this lack of communication: (1) the exclusively state-funded nature of the project, implying a less comprehensive environmental impact review than that mandated for federally-funded highways; and (2) the relative isolation of the parochial institution, both from the general public and from public channels of communication, such as school boards, County supervisors, etc. The Army acted as a catalyst in keeping with its interests in sustaining a "good neighbor" role in the community. Once the problem had been identified by the Army, all parties worked cooperatively and developed a satisfactory solution.

CHRONOLOGY -- ST. THOMAS MOORE

1940:	Construction of St. Thomas Moore School.
1972:	Completion of most recent improvements to the school.
Spring 1976:	State Highway Department notifies Arlington Hall Station of impending start-up of construction.
May 1976:	Construction began to widen Route 50 from 4 lanes to 6.
August-September 1977:	Projected completion date for expansion project.

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case study background data

school

Cameron Elementary
Alexandria, Virginia
Fairfax County Public Schools

Public, K-6, 350 students

1953: Construction of original 2-story building

1970: Single story wing

Masonry construction

Ballfields and strip of County Park lie between the school building and the Beltway

highway

I-495, Capital Beltway

(Segment at Telegraph Road)

8 lanes with landscaped median

1964: Construction completed of 6-lane Beltway

1974: Construction of 2 additional lanes undertaken

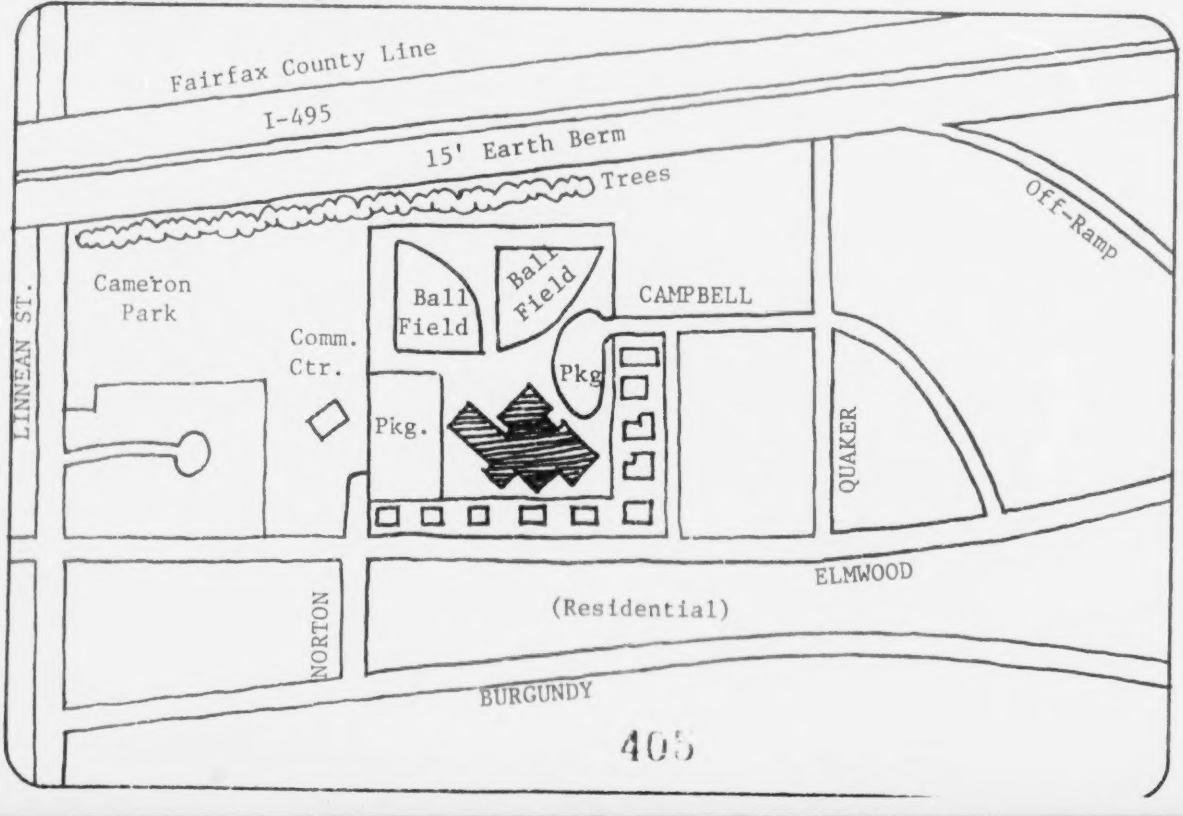
1976: Installation of 15' earth berm

Summer 1977: Projected completion of sound barrier and 8 lanes

ADT: DY 65,000-85,000

11% Truck Composition

situational diagram



I. SITUATIONAL CONTEXT

A. Highway

Interstate 495, known as the Capital Beltway, passes within several hundred feet of the playground of Cameron Elementary School. The highway is currently being expanded from six to eight lanes in width, with a landscaped median strip. There is a 15-foot earth berm along the southern boundary of the highway, and a continuous 8-foot chain link fence delineating the edge of the right-of-way. The design year ADT 65,000-85,000.

The Beltway encircles the greater Washington metropolitan area, through Maryland and Virginia. Regional planners first proposed it in the early 1950s, as an essential element of the suburban center development pattern. Following passage of the Federal Aid Highway Act in 1956, planning and route selection activities occurred in 1957-1958. Construction was undertaken in 1958. Sections of the highway were opened as completed; the entire Beltway was completed by 1964.

The Virginia segment, 22 miles in length, originally consisted of sections varying from four to six lanes in width. After several years of operation, the Virginia Department of Transportation initiated plans to widen the Virginia segment to eight lanes, based on its assessment of traffic demand. Under FHA guidelines, the project includes environmental impact assessment and abatement activities (as appropriate) along both sides of the Beltway.

In October 1974, construction of the improvements began on the segment adjacent to Cameron School. The earth berm was installed in spring 1976.

The berm is scheduled for landscaping in spring 1977, to be followed by construction of a concrete wall 10 feet to 12 feet in height along the top of the earth berm. The construction of the additional lanes is nearing completion.

B. School

Cameron Elementary School is a public school of Fairfax County, Virginia. Current enrollment is 350, in grades K-6. Beginning in the fall 1977, the school will also offer a Pre-School Day Care Program and Adult Education classes.

The school site comprises eight acres of playground, including two ball fields, and a single school building. Adjoining the site on two sides is a 7.4 acre County park, Cameron Park. The park contains a picnic area, tot lot, open play field, natural areas, and the Burgundy Village Recreation Center.

The original two-story unit of the school was constructed in 1953. In 1958, the building was extended to create additional classrooms. The most recent additions, in 1970, consisted of a gymnasium; and a single story wing containing several classrooms, a music room, science laboratory, and office suite. All construction is masonry, and there is central air conditioning in the newest wing only. With the last addition, the front entrance to the school was changed from a southern entry to the northeast side of the new wing.

The ball fields lie between the school building and the strip of Cameron Park immediately bordering the Beltway right-of-way. In the corner formed by the abutting new and old wings is a hardtop play area. There is another hardtop area to the west, and parking area and entrance drive to the east.

In accordance with its community orientation and because of its proximity to the Park and Community Center, the school is used for a variety of community activities, including recreation, meetings, University classes, fairs, drill teams, etc.

C. Proximity Relationships

The segment of the Beltway adjacent to the school follows a low ridgeline demarcating the hillier terrain to the south from the more gentle northern topography. It is visible and audible from the school and neighboring residential streets. Relative to the school, which is at sea level, the Beltway is elevated (on fill) approximately three feet. Before the Beltway, the site was characterized by bogs and marshland. There is a stand of semimature oaks in the strip of park land separating I-495 from the school property.

The distance from the classrooms of the older, nearer unit to the Beltway is approximately 300 feet.

The school draws students exclusively from the residential area south of the Beltway. To the north is industrial development. The most commonly used access to the freeway is Telegraph Road, approximately one-half mile to the east. Telegraph Road also demarcates the walking/busing districts. Students residing west of Telegraph walk to school by way of residential streets. (This area is known as Burgundy Village.) All students east of Telegraph Road are bussed. Buses enter the school site at the front driveway, and discharge and load students directly in front of the main entrance. Parents bringing or picking up children in private cars drive to the back entrance.

The neighborhood is residential, consisting of older, single-family, detached homes. There has been no influx of young families; consequently the school-age population is declining. Enrollment at Cameron is down nearly 40 percent since 1971. However, the local Civic Organization has been increasingly active in community affairs, such as the planned improvements to Cameron Park.

In 1970, the school had the highest vandalism rate in the County. Since that time, under a new principal, the rate has dropped dramatically.

II. IMPACTS

A. On School

In connection with the original construction of the Beltway, there were no efforts undertaken by the Department of Highways and Transportation to measure or mitigate adverse environmental impacts. Planning and construction occurred prior to enactment of the NEPA guidelines, related directives in the Federal Aid Highway Program Manual, the Virginia Environmental Quality Act, and the formation of the Environmental Quality Division of the Department in 1971.

Similarly, there is no record of school user, community, or other local initiatives to address the noise impact of the original Beltway. Some teachers at the school who had been there prior to construction of the Beltway remembered the change in noise level as objectionable; another did not. Members of the Civic Organization, which uses the Community Center as a meeting place, found it very difficult to conduct meetings with windows open. However, both long-term residents and teachers regarded the noise as something one "learned to live with." By contrast, teachers who came to the school after construction of the Beltway had sharper comments on the noise impact. The principal, who came to the school in 1971, first encountered the situation in connection with the use of the adjacent park. Teachers wanting to use the area as an outdoor classroom, and particularly for "nature walks," asked the principal to clarify with the County whether such use was permissible. Having done so, when the teachers attempted to use the Park, they discovered that normal conversation and instruction could not be heard above the traffic noise.

One teacher, whose classroom is located on the second floor of the older unit, closest to the Beltway, felt strongly that the traffic noise was a disturbance in her classroom. She said that it had caused her to change teaching methods, specifically, to make more use of individual reading and other activities not requiring extensive verbal instruction. The windows of this and adjacent rooms face the Beltway, and must be open in spring and fall for ventilation. The exterior wall of the classroom also reflects the traffic noise onto the hardtop play area below. The noise of activities in this area is, in turn, conveyed up to the classrooms. The physical education teacher reported that the noise interfered with her giving instruction out-of-doors.

Other impacts included changes in the boundaries of the enrollment area; and some initial personal and property safety concerns related to "floating gangs" on the Beltway. The Beltway cut off three residential streets in the neighborhood, which now terminate in dead ends. The northern boundary of the school enrollment area was redefined coterminous with the Beltway, resulting in the referral of seven families to other schools. Also, in the early 1970s, there were cases of reported "floating gangs" on the Beltway, utilizing the interstate roads from as far away as Baltimore and Philadelphia. The school experienced excessive vandalism during this period, and was burglarized; but no connection with the Beltway group was established. On the Maryland segment, there were several cases of child kidnapping and murder that were associated with the Beltway.

Noise impact assessment in connection with the improvements included technical studies of noise levels; and a public involvement methodology utilizing both personal interviews in the home and informal public meetings. In 1974, before inception of the present expansion project, readings were taken at noise-sensitive structures along the Beltway to determine existing noise levels and design year levels for both build and no-build alternatives. Advanced techniques and equipment were employed, including highway line source computer models for projecting future sound levels.

For the six-lane segment adjacent to Cameron, noise contours for exterior conditions were established at 70-75 dBA under existing conditions, and 72-77 dBA in the design year, without abatement measures. According to the Department, readings were not taken at the Cameron site itself. However, the principal recalled a visit by Department engineers "after the leaves had fallen," during which the physical layout of the school was reviewed and relationships to the Beltway measured.

The content of the attitudinal surveys administered in the homes and at public meetings spanned both impact assessment and public preferences with regard to noise abatement measures. The questions pertained to history of residence, attitudes toward the neighborhood, characteristic activities, perceptions of visual and audial impacts, preferences regarding abatement measures, and general socioeconomic background. (Appendix A contains samples of interview formats and associated correspondence.) Burgundy Village, the neighborhood adjacent to Cameron School, was surveyed in April 1975, by home visits to a stratified random sample of 31 households. In other neighborhoods surveyed prior to Burgundy Village, institutional responses from churches, nursing homes, and public park administrators had been sought. The Department did not interview spokespersons for Cameron School or Cameron Park because the findings on institutions in other areas, combined with the technical studies of existing and projected noise levels, already established the need for some type of abatement measure along the immediately adjacent Beltway segment. (Furthermore, it was the understanding of the public survey director that Cameron School has been apprised of the study in connection with the work of the noise technicians.) In fact, the principal of Cameron School remained uninformed of the residential survey or even the likelihood of additional measures, as implied by the substance of his letter to the Administrative Officer for Fairfax County Public Schools in June 1975. He had read in the newspaper that the Department of Highways and Transportation was considering noise abatement measures for another area impacted by the Beltway; and wrote to request that Cameron School be included in any such considerations. His referral of the matter to the School District (rather than direct communication to the Department of Highways and Transportation) reflects requisite administrative practice. He never received a response.

The findings of the survey of the Burgundy Village Area (Section A, Group 1), included:

- Almost exclusively homeowners, the vast majority indicated satisfaction with the neighborhood, of which convenience was a popularly noted advantage. Asked to identify disadvantages of the neighborhood, approximately one-half mentioned congestion, noise, and Route 495; the other half disliked nothing.

- Over one-half characterized noise as a problem, particularly noticeable at commute hours. Thirteen of the 31 favored construction of an abatement feature; 20 approved landscaping with no abatement feature.[1]

B. On Highway

Impacts of the school on the highway were considered by all to be virtually non-existent. There were a few reported instances of children getting under the chain link fence to fish in a stream that divides the Park, flowing from south to north, and running underneath the Beltway. There were also a few cases of children using "walkie talkies" to communicate with passing trucks. The principal suggested that had the vandalism problem not been reduced so successfully, there might have been instances of vandalism or destruction in connection with the chain link fence, the berms, or proposed wall.

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[1] Lisa E. Read and Robert H. Blackman, Virginia Department of Highways and Transportation, Environmental Quality Division, Phase III Report -- Personal Interviews, Route I-495 Section A, Northern Virginia, Group 1, State Project #0495-029-102, PE-102, July 1975.

IV. MITIGATION

This discussion focuses exclusively on mitigation efforts with respect to the noise impacts as measured by the highway department in connection with the improvements to the Beltway. As mentioned, no efforts to measure or mitigate the noise impacts were undertaken in connection with the original construction. Nor was there protest to the change in the enrollment area.

The noise impact assessment activities of the highway department incorporated studies to guide selection of abatement features as well. The technical studies included projections of noise levels with and without abatement. The survey questionnaire specified available alternatives of walls and/or earth berms, 14 to 20 feet in height, and, space permitting, landscaped; landscaping exclusively; and no abatement feature. Respondents were asked to express preferences among these alternatives.

Subsequent to the household survey and analysis of findings, the Department sponsored "informal" public meetings to present information about the noise abatement project to residents, and to elicit public response. The Department requested the use of Cameron School to speak to residents of Burgundy Village and adjoining neighborhoods, and the meeting was scheduled for December 2, 1975. The Department sent letters to residents and selected local agencies and officials inviting their participation. The County Supervisor for the District had already contacted the Department to request that he be involved in the public opinion effort. Like the principal, he and other members of the Fairfax County Board of Supervisors learned that noise abatement projects were underway elsewhere on the Beltway corridor, and was interested in the possibilities for his own District. He served as moderator for the meeting, along with the president and vice-president of the Burgundy Village Civic Organization. The Department provided schematics, contours, and drawings for public review at the meetings. Engineers from the Location and Design Division, and Noise Specialists from the Environmental Quality Division, each made presentations regarding the history of the noise abatement project, and fundamentals of noise and noise abatement. Alternative abatement strategies were presented by the Department as options. These included:

- earth berms of a range of heights
- fence, either concrete or wooden, of a range of heights
- landscaping
- combinations of the above
- no abatement measure

Landscape architects and sociologists from the Environmental Quality Division were also available for the question and answer section. Participants were asked to complete a one-page questionnaire regarding their preferences for noise abatement features and the effectiveness of the Department's public outreach effort.

Attendance at this meeting was low, fourteen individuals from four neighborhoods. Of the completed 13 questionnaires, all approved the construction of an abatement feature. A second meeting was scheduled for December 17, 1975 to attempt to improve attendance. The County Supervisor and Civic Organization representatives undertook their own mailing of departmental literature. Twelve persons attended this meeting. Of the nine completed questionnaires, eight favored an abatement feature. A third meeting had also been scheduled, but was cancelled by the Department, based on the low attendance rate at the first and second meetings. Although attendance was poor, both the County Supervisor and the Department of Highways and Transportation were impressed with the level of interest and understanding expressed by participants. At this time, representatives of the Department spoke with the principal of Cameron about his concerns for the school. Asked their impressions of the Department's presentations, both the school principal and the County supervisor characterized it as "professional" and thorough.

In January 1976, the Department wrote to the principal requesting information about the school: uses, time schedules, physical layout, etc.

Based on the findings of the technical studies, public surveys, design and cost-effectiveness considerations, the Department selected the abatement option to be utilized in each area and, typically, sent informative letters to residents announcing the decision and describing the abatement feature. In the case of the Burgundy Village section, the Department did not notify residents because the proposal continued to be modified over time. However, the principal stated that by early spring he understood that an earth berm and a concrete wall were to be installed, although there had been no official communication. Construction of the earth berm began in spring 1976; the segment adjacent to the school has been completed. The berm for this segment is 15 feet in height. Landscaping will be undertaken in May 1977, and then a concrete wall of 10 feet to 12 feet height will be built on top of the berm. Completion is scheduled for late summer 1977.

The Department has projected the following decibel readings at the school site for the Beltway with abatement feature:

Exterior	DY	64-68 dBA
Interior (facing I-495)		
Ground level	DY	54 dBA
Second level	DY	58 dBA

The Department plans to conduct field readings after construction of the berm to determine actual noise levels.

Since the projected ground level interior reading is within the 55 dBA federal guideline, and the second story reading is only three points in excess, it is unlikely that the Department will pursue additional abatement measures, such as sound insulation or air conditioning of the building.

It is anticipated that the cost of sound abatement measures for I-495 will total $3-4 million.

Unaware of the Department's findings and projections with regard to noise levels, the principal stated that it was his understanding that the abatement features would not decrease the decibel level to federal guidelines. However, he had observed that the berm had effectively eliminated the whine of the tires, and expressed hope that the concrete wall would eliminate noise from the truck stacks. Asked his plans should the abatement prove unsatisfactory, he indicated that he was not aware of recourse to pursue additional measures; and hoped that air conditioning would eventually be feasible under school modernization programs.

Since the Community Center has recently been air-conditioned, the impact of noise from the Beltway has decreased, and no measure of reduction exclusively attributable to the berm is possible.

IV. SUMMARY AND RECOMMENDATIONS

- The noise impact assessment and mitigation selection activities were successful, in that the project has been implemented without objection; and the mitigation measures, to the current stage of completion, have been satisfactory to representatives of the community (e.g., the school principal and Civic Organization members). This is particularly significant in light of the relatively lively interest demonstrated by Northern Virginia communities in other highway projects. The growing interest in environmental issues is apparent both in public attitudes and the approach of the highway department. In this case, the highway department initiated the bulk of public contact. Both the technical studies and the public involvement methodology were the most comprehensive efforts of their kind implemented to date in Virginia. This effort apparently contributed greatly to the successful outcome of the project.

- The principal can contribute to the planning process in several ways: source of information regarding impacts; leadership in the community; contact and outreach to residents and parents; advocacy for alternatives among mitigation measures. Given the low attendance rate at the public hearings, and the value acknowledged by the department of the principal's comments at those meetings, it would be desirable to increase the principal's role in the planning process. Apparently the highway department usually does contact the principal directly. The failure here to include the school in the public survey was attributable to a simple mix-up within the department itself, regarding the assumed nature of contact by the noise technicians; and to a predetermination of need based on the responses of institutions in other areas and on the findings of the noise studies. There is also the consideration that additional communication between the highway department and the principal (beyond that engaged in at the public meetings) -- to inform him of the scope and inception date of the study and the findings for certain mitigation measures -- is in itself desirable, in the interest of public information. In this case, it would also have spared the principal some wasted effort and misunderstanding.

- The improvements to the existing Beltway created the opportunity for implementation of a noise abatement project. In many cases, the scope of environmental review activities in connection with roadway improvements will include both the unmitigated adverse impacts of the original construction (existing conditions) and those of planned improvements. In states such as Virginia where impact abatement projects are not being undertaken on existing conditions, and extensive new construction is not foreseen, roadway improvement projects offer the best opportunity for mitigation activities.

- Attendance at the public meetings for this neighborhood was low. The highway department suggested that this was attributable to the coincidence of timing with the holiday season, and that other seasons were more conducive to public participation. The Cameron School principal suggested that the low socioeconomic profile of the community relative to the apparent background of the highway department representatives also inhibited participation on the part of residents.

- The planning and implementation of the noise abatement project took one and one-half years prior to construction. The interviews and analysis of findings appear to have been conducted relatively quickly. The bulk of time appears to have been spent on the preliminary technical studies and design of the public involvement element. Since these activities will be replicated with each noise abatement project, and lend themselves to a routine approach, it is likely that future projects can be performed more quickly, based on the experience gained from this project.

- The highway department opted for consideration of noise abatement features along the Beltway, rather than modifications of impacted structures. This was possible because the original Beltway right-of-way was adequate for such projects.

- It was the suggestion of the highway department that the high costs of noise abatement measures warranted the most technically precise measurements and projections of physical impacts as could be achieved, to enable selection of the most cost-effective mitigation approach. The department's noise specialist considered that Virginia's studies far exceeded the level of investigation required by federal guidelines, and that this was desirable. Consideration should be given to mandating more precise technical guidelines.

- One advantage to the use of earth berms rather than concrete walls is the relatively more desirable visual effect. The department's noise specialist commented that the most effective noise abatement techniques by far were those applied at the noise source. Given muffling of vehicle noise, roadway and structural modifications would no longer be necessary. Anticipation of such technology was an additional argument for the choice of earth berms, which, although obsolete as noise barriers, would still contribute to enhancement of the physical environment.

- The design of the school illustrates the well-known lesson that classrooms in the second story of a school will tend to experience greater noise and air pollution impacts because of the outlet heights of truck exhaust stacks. In this case, the situation is aggravated by the blacktop surface immediately beneath the second story windows, used for children's play activities.

CHRONOLOGY -- CAMERON ELEMENTARY SCHOOL

1953:	Construction of original school building, 2 stories, masonry.
1957-1958:	Planning for Beltway.
1958:	Construction of additional classrooms.
1964:	Completion of Beltway.
1970:	Construction of "new" section, single story, masonry, containing 7 classrooms, a gymnasium, music rooms, science lab, and office suite.
1973-1974:	Impact studies on proposed widening to 8 lanes.
1974-1975:	Expanded noise impact studies.
October 1974:	Construction begun to widen adjacent segment of Beltway from 6 lanes to 8 lanes.
Spring 1976:	Installation of the earth berm.
Summer 1977:	Projected completion of sand barrier and 8-lane Beltway.

PERSONS CONTACTED: CAMERON ELEMENTARY SCHOOL

Dr. Douglas W. Dalton
Principal
Cameron Elementary School
3434 Campbell Drive
Alexandria, Virginia 22303
(703) 960-2323

Mr. Ed Ferber
Highway Coordinator
National Capital Park and Planning Commission
8787 Georgia Avenue
Silver Spring, Maryland

Mr. Robert Mannell
Location and Design Engineer
Virginia Department of Highways and Transportation
1221 E. Broad Street
Richmond, Virginia 23219
(804) 786-2548

Mr. Joseph Alexander
County Supervisor, Lee District
Fairfax County Board of Superintendants
6121 Franconia Road
Alexandria, Virginia 22310
(703) 971-6262

Mr. Nathaniel J. Orleans
Assistant Superintendant for Planning Services
Fairfax County Public Schools
Robinson Secondary
5035 Sideburn Road
Fairfax, Virginia 22030

Mr. Ahmet C. Anday
Coordinator, Noise and Air Quality Section
Virginia Department of Highways and Transportation
#301, 1401 E. Broad
Richmond, Virginia 23219
(804) 786-6556

Ms. Chris Strait
Member, Burgundy Village Civic Organization
(703) 971-6262 Office

Mr. Robert H. Blackman
Environmental Specialist/Sociologist
Virginia Department of Highways and Transportation
#201, 1401 E. Broad
Richmond, Virginia
(804) 786-4428

Mr. David Steadman
Former President, Burgundy Village Civic Organization
(703) KI-9-7115

APPENDIX A

PUBLIC SURVEY DOCUMENTATION

B. FUGATE, COMMISSIONER
R. HALL, BRISTOL, BRISTOL DISTRICT
G. FRALIN, ROANOKE, SALEM DISTRICT
R. GLASS, LYNCHBURG, LYNCHBURG DISTRICT
M. CROWE, RICHMOND, RICHMOND DISTRICT
T. ROOS, YORKTOWN, SUFFOLK DISTRICT
G. JANNEY, FREDERICKSBURG, FREDERICKSBURG DISTRICT
A. BEETON, FALLS CHURCH, CULPEPER DISTRICT
E. LANDES, STAUNTON, STAUNTON DISTRICT
E. RAY HASSELL, III, CHESAPEAKE, AT LARGE URBAN
ARLES S. HOOPER, JR., CREWE, AT LARGE RURAL

COMMONWEALTH OF VIRGINIA

DEPARTMENT OF HIGHWAYS & TRANSPORTATION
1221 EAST BROAD STREET
RICHMOND, 23219

JOHN E. HARWOOD
DEPUTY COMMISSIONER & CHIEF ENGINEER
W. S. G. BRITTON
DIRECTOR OF ADMINISTRATION
H. GORDON BLUNDON
DIRECTOR OF PROGRAM MANAGEMENT
J. M. WRAY, JR., DIRECTOR OF OPERATIONS
J. P. ROYER, JR.
DIRECTOR OF PLANNING
P. B. COLDIRON, DIRECTOR OF ENGINEERING

IN REPLY PLEASE REFER TO

April 23, 1975

Dear Resident:

The Virginia Department of Highways and Transportation is in the process of conducting a survey to obtain citizen input on Noise from Interstate Route 495 and the feasibility of constructing noise abatement features.

A team of interviewers from the Environmental Quality Division will be in your community during the week of April 28 through May 1.

The interview process will take no more than twenty minutes, and your assistance will be greatly appreciated.

The Interview Team will consist of Miss Cynthia Read, Miss Robbin Peach, Mr. Proctor Harvey and Mr. Robert Blackman. Each person will have proper identification; however, if you should have any doubts, please feel free to contact Mr. D. E. Keith, Resident Engineer, at 273-0660.

Sincerely,

R. L. Hundley
R. L. Hundley
Environmental Quality Engineer

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Interview Number ________
Group Number ________
Respondent's Address ______________________________

Date ____________
Interviewer ________

I-495-A Interview

1. How long have you lived at this address? years______ months________

2. Do you own ( ) or rent ( ) your present home?

3. What are the chances that you will move from this neighborhood within the next three years?

   very likely ( )
   moderately likely ( )
   not likely ( )
   don't know ( )

4. Including yourself, how many people live in this household?__________

5. How many of those living here are under 18 years of age?____________

6a. What things do you particularly like about living in this area?_______

____

6b. What things do you particularly dislike about living in this area?____

____

7. In general, how do you feel about this area as a place to live?

   very satisfied ( )
   satisfied ( )
   indifferent ( )
   dissatisfied ( )
   very dissatisfied ( )

8. How frequently do members of your household use areas surrounding your home for outside activities?

   daily ( )
   a few times a week ( )
   weekly ( )
   monthly ( )
   a few times a year ( )
   almost never ( )

9. Which areas surrounding your home are used by your household for these activites? (more than one response may be checked)

   front yard ( )
   back yard ( )
   porch or balcony ( )
   other (specify)______________________________
   pool ( )
   game court ( )
   children's play area ( )

10. What are the locations of these activity areas relative to I-495?

____

11. During what time of day do these activities take place? (more than one response may be checked)

7 to 9 AM ( )
9 to 11 AM ( )
11 AM to 1 PM ( )
1 to 3 PM ( )

3 to 5 PM ( )
5 to 7 PM ( )
7 to 9 PM ( )
after 9 PM ( )

12. I would like your opinion about two aspects of Route I-495 and how they affect you.

a. The view of Route I-495 from your home - Would you say it:

is not a problem ( )
is somewhat of a problem ( )
is a problem ( )
has no effect ( )

Can you see I-495 from your home? Yes ( ) No ( )

b. Noise from Route I-495 - Would you personally say it:

is not a problem ( )
is somewhat of a problem ( )
is a problem ( )
has no effect( )

13a. In the period of time you have lived here, has your awareness of the view of the road:

remained the same ( )
increased ( )
decreased ( )

If it has increased or decreased, what was the cause?

____

13b. Has your awareness of the noise level:

remained the same ( )
increased ( )
decreased ( )
adjusted to ( )

If it has increased or decreased, what was the cause?

____

14. Are there any times during the day when noise from I-495 is particularly noticeable?

yes ( ) no ( )

If so, when?____

The Department of Highways and Transportation is considering various alternatives for providing noise abatement features and landscaping on I-495 in an effort to reduce noise levels for residents in the immediate vicinity of the roadway. The purpose of the following questions is to determine residents' attitudes toward possible action that can be taken on this situation. There are tradeoffs - good and bad points - for each of the alternatives being considered. The abatement features may consist of walls and/or earth berms totalling 14 to 20 feet in height. Placement of noise barriers in some areas may require removal of some of the existing trees. Where space permits, barriers will be landscaped. Landscaping with 10 foot trees with no noise abatement feature is also an alternative; however, such an option would provide visual screening of the roadway and would not reduce noise levels. Finally, there is the alternative of doing nothing.

I would like to ask your opinion regarding the proposed alternatives as to whether you strongly approve, approve, disapprove, strongly disapprove or have no preference.

15a. Placement of an abatement feature:

strongly approve ( )
approve ( )
no preference ( )
disapprove ( )
strongly disapprove ( )

b. Placement of an abatement feature where some existing trees would be removed:

strongly approve ( )
approve ( )
no preference ( )
disapprove ( )
strongly disapprove ( )

c. Landscaping with trees and no abatement feature:

strongly approve ( )
approve ( )
no preference ( )
disapprove ( )
strongly disapprove ( )

d. Do nothing:

strongly approve ( )
approve ( )
no preference ( )
disapprove ( )
strongly disapprove ( )

16 Have you ever attended a highway public hearing dealing with the location or design of a proposed roadway?

yes ( )
no ( )

17. Would you be interested in attending an informal meeting on the consideration of these noise abatement alternatives where you could receive more information about the project and have an opportunity to further express your views?

yes ( )   no ( )   indifferent ( )

18. The Virginia Department of Highways and Transportation is considering holding an informal meeting on noise abatement alternatives for I-495. This meeting would be held at a location near your home, on a weeknight, and during the early evening. Would this arrangement be convenient for you to attend such a meeting?

yes ( )   no ( )

If no, why not?____

19. Will there be any days within the next month when you would be unable to attend such a meeting?

yes ( )   no ( )

If so, when?____

20. What are your feelings about obtaining citizens' opinions through interviews and informal meetings before highway alternatives are selected?

good idea ( )   indifferent ( )
bad idea ( )   other________________________

21. What is your name?____
(Last)   (First)

22. Age of Respondent__________________, not offered ( ).

23a. Respondent's occupation__________________, not offered ( ).

23b. Spouse's occupation____________________, not offered ( ).

(To Be Completed After Interview)

24. Sex of respondent M ( ) F ( )

25. Race of respondent White ( ) Black ( ) Oriental ( )

26. Type of dwelling unit?

single family detached ( ) apartment ( )
single family attached ( ) institution ( )
other ( )

27. How cooperative was the respondent?

very cooperative ( ) uncooperative ( )
cooperative ( ) very uncooperative ( )
indifferent ( )

28. How confident do you feel about the factual information the respondent gave you?

completely confident ( ) have some doubts ( )
reasonably confident ( )

29. Length of interview ______________ minutes.

Interviewer's comments: ______________________________

____

____

____

____

____

[illegible] FUGATE, COMMISSIONER
[illegible] W. HALL, BRISTOL, BRISTOL DISTRICT
[illegible] G. FRALIN, ROANOKE, SALEM DISTRICT
[illegible] R. GLASS, LYNCHBURG, LYNCHBURG DISTRICT
[illegible] M. CHOWS, RICHMOND, RICHMOND DISTRICT
WILLIAM T. ROOS, YORKTOWN, SUFFOLK DISTRICT
DOUGLAS G. JANNEY, FREDERICKSBURG, FREDERICKSBURG DISTRICT
RALPH A. BEETON, FALLS CHURCH, CULPEPER DISTRICT
ROBERT S. LANDES, STAUNTON, STAUNTON DISTRICT
T. RAY HASSELL, III, CHESAPEAKE, AT LARGE URBAN
CHARLES S. HOOPER, JR., CREWE, AT LARGE RURAL

R. L. HUNDLEY
ENVIRONMENTAL QUALITY ENGINEER

305

COMMONWEALTH of VIRGINIA
DEPARTMENT OF HIGHWAYS & TRANSPORTATION
1221 EAST BROAD STREET
RICHMOND, 23219

JOHN E. HARWOOD
DEPUTY COMMISSIONER & CHIEF ENG
W. S. G. BRITTON
DIRECTOR OF ADMINISTRATION
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DIRECTOR OF PROGRAM MANAGEMEN
J. M. WRAY, JR.
DIRECTOR OF OPERATIONS
J. P. ROYER, JR.
DIRECTOR OF PLANNING
P. B. COLDIRON
DIRECTOR OF ENGINEERING

IN REPLY PLEASE REFER TO

November 17, 1975

Interstate Route 495
0495-029-112, PE101, C501
Fairfax County
Section A

Mr. John Herrity, Supervisor
Springfield District
6623 Backlick Road, Room 211
Springfield, Virginia 22150

Dear Mr. Herrity:

This letter is to inform you of the public meetings scheduled for Section A of the I-495 Noise Abatement Study. The following dates and locations have been reserved for meetings with the affected public.

December 2, 1975 - Cafeteria - Cameron Elementary School
3434 Campbell Drive
Alexandria, Virginia 22303

Study Groups 1, 2, 4 and 7

December 3, 1975 - Cafeteria - Cameron Elementary School
3434 Campbell Drive
Alexandria, Virginia 22303

Study Groups 3, 5 and 6

The Department of Highways and Transportation would like to extend a personal invitation to you or any representative from your office to attend this meeting.

Sincerely yours,

R. L. Hundley

R. L. Hundley
Environmental Quality Engineer

RH3:jn

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DOUGLAS B. FUGATE, COMMISSIONER
LEONARD R. HALL, BRISTOL, *BRISTOL DISTRICT*
HORACE G. FRALIN, ROANOKE, *SALEM DISTRICT*
THOMAS R. GLASS, LYNCHBURG, *LYNCHBURG DISTRICT*
MORRILL M. CROWE, RICHMOND, *RICHMOND DISTRICT*
WILLIAM T. ROOS, YORKTOWN, *SUFFOLK DISTRICT*
DOUGLAS G. JANNEY, FREDERICKSBURG, *FREDERICKSBURG DISTRICT*
RALPH A. BEETON, FALLS CHURCH, *CULPEPER DISTRICT*
ROBERT S. LANDES, STAUNTON, *STAUNTON DISTRICT*
T. RAY HASSELL, III, CHESAPEAKE, *AT LARGE-URBAN*
CHARLES S. HOOPER, JR., CREWE, *AT LARGE-RURAL*

COMMONWEALTH OF VIRGINIA

DEPARTMENT OF HIGHWAYS & TRANSPORTATION
1221 EAST BROAD STREET
RICHMOND, 23219

JOHN E. HARWOOD
DEPUTY COMMISSIONER &
W. S. G. BRITTON
DIRECTOR OF ADMINISTRATIO
H. GORDON BLUNDON
DIRECTOR OF PROGRAM
J. M. WRAY, JR., DIRECTOR OF
J. P. ROYER, JR.
DIRECTOR OF PLANNING
P. B. COLDIRON, DIRECTOR OF

IN REPLY PLEASE REFER TO

December 10, 1975

Interstate Route 495
0495-029-112, PE101, C501
Fairfax County
Section A

Dear Resident:

The Virginia Department of Highways and Transportation is considering various alternatives for providing noise abatement features which would reduce noise levels for residents in the immediate vicinity of the roadway. One of our interviewers has probably contacted you to obtain your initial views on this matter. An informal meeting has now been arranged for the purpose of presenting project information to the residents and listening to their response.

The meeting will be held on December 17, 1975, in the Pod Room, which is located directly to your left as you enter the Cameron Elementary School, 3434 Campbell Drive, Alexandria, Virginia. Project plans will be available for public inspection from 7:00 P.M. to 7:30 P.M. with the meeting beginning at 7:30 P.M. Representatives from the Department of Highways and Transportation will discuss the alternatives under consideration and will answer questions regarding these proposals.

The Virginia Department of Highways and Transportation is striving to involve the local citizens in its highway programs, and your attendance and participation at this meeting would be greatly appreciated.

Sincerely,

J. E. Harwood
Deputy Commissioner and Chief Engineer

RHB:jhh
bl.cc.: Mr. D. B. Hope
Mr. D. E. Keith
Mr. W. L. Brittle, Jr.
Mr. R. L. Hundley
Mr. E. T. Robb
Mr. W. D. Gilbert
Mr. L. H. Rutledge, Jr.
Mr. A. C. Anday
Mr. P. L. McDade
Mr. M. D. O'Neal
Miss Lisa Read

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I-495-B - PUBLIC MEETINGS

Moderator	Senator Adelard L. Brault 34th Senatorial District
Representatives	Virginia Department of Highways and Transportation
	Mr. Don Keith - Resident Engineer - Fairfax Residency
	Messrs. R. A. Mannell and W. E. Whitman - Engineers - Location and Design Division
	Messrs. A. C. Anday and M. D. O'Neal - Noise Specialists - Environmental Quality Division
	Messrs. L. H. Rutledge, Jr. and P. L. McDade - Landscape Architects - Environmental Quality Division
	Miss Lisa Read and Mr. R. H. Blackman - Sociologists - Environmental Quality Division

AGENDA

7:00 to 7:30 P.M.	Open viewing of project information by the public
7:30 to 7:45 P.M.	Introductory comments - Senator Brault
7:45 to 8:00 P.M.	Discussion of I-495 noise abatement project history - Mr. Mannell
8:00 to 8:15 P.M.	Discussion of fundamentals of noise and noise abatement - Mr. Anday
8:15 P.M. - until	Questions and answer session between residents and Highway Department representatives

IMPORTANT -- Please return your completed questionnaire before leaving.

Should you have any further comments or questions after this meeting, please address them to:

Mr. Robert H. Blackman, Sociologist
Virginia Department of Highways and Transportation
1401 East Broad Street - Room 205 - Chemical Building
Richmond, Virginia 23219

I-495-B Public Meeting Questionnaire

This meeting has involved a discussion of noise abatement and landscaping techniques and their effect upon residents living in the immediate vicinity of I-495. The purpose of the following questions is to solicit residents' attitudes toward the alternatives under consideration. Please indicate your feelings regarding each one of the alternatives listed below.

1a. Placement of a noise abatement feature:
strongly approve ( ) no preference ( ) disapprove ( )
approve ( ) strongly disapprove ( )

1b. Landscaping with trees and no abatement feature:
strongly approve ( ) no preference ( ) disapprove ( )
approve ( ) strongly disapprove ( )

1c. Do nothing:
strongly approve ( ) no preference ( ) disapprove ( )
approve ( ) strongly disapprove ( )

2. We would like your opinion about two aspects of Route I-495 and how they affect you:

a. The view of Route I-495 from your home - Would you say it:
is not a problem ( ) is a problem ( )
is somewhat of a problem ( ) has no effect ( )

During the summer, can you see I-495 from your home?
yes ( ) no ( )

b. Noise from Route I-495 - Would you personally say it:
is not a problem ( ) is a problem ( )
is somewhat of a problem ( ) has no effect ( )

3. How would you rate this meeting as a method of obtaining citizen opinions?
very effective ( ) partially effective ( ) ineffective ( )
effective ( ) very ineffective ( )

4. How would you rate this meeting as a method of presenting information to citizens?
very effective ( ) partially effective ( ) ineffective ( )
effective ( ) very ineffective ( )

5. Are there any changes you would suggest for improving these public meetings?
no ( ) yes ( ) ______________________________
(please list)
____

6. What is your name? ______________________________
(last) (first)

7. What is your home address? ______________________________
(street)
____
(town) (zip code)

Space for additional comments, questions, suggestions:
____
____

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COMMON INDOOR AND OUTDOOR NOISE LEVELS

COMMON OUTDOOR NOISE LEVELS	NOISE LEVEL dB(A)	COMMON INDOOR NOISE LEVELS
	110	Rock Band
Jet Flyover at 1000 ft.		
	100	
		Inside Subway Train (New York)
Gas Lawn Mower at 3 ft.		
	90	
		Food Blender at 3 ft.
Diesel Truck at 50 ft.		
Noisy Urban Daytime		Garbage Disposal at 3 ft. Shouting at 3 ft.
	80	
Gas Lawn Mower at 100 ft.	70	Vacuum Cleaner at 10 ft.
Commercial Area		Normal Speech at 3 ft.
Heavy Traffic at 300 ft.	60	
		Large Business Office
Quiet Urban Daytime	50	Dishwasher Next Room
Quiet Urban Nighttime	40	Small Theatre, Large Conference Room (Background)
Quiet Suburban Nighttime		
		Library
	30	
Quiet Rural Nighttime		Bedroom at Night Concert Hall (Background)
	20	
		Broadcast and Recording Studio
	10	
		Threshold of Hearing
	0	

UGLAS B FUGATE, COMMISSIONER
EONARD R HALL, BRISTOL, *BRISTOL DISTRICT*
ORACE G FRALIN, ROANOKE, *SALEM DISTRICT*
HOMAS R GLASS LYNCHBURG, *LYNCHBURG DISTRICT*
ORRILL M CROWE, RICHMOND, *RICHMOND DISTRICT*
ILLIAM T ROOS YORKTOWN, *SUFFOLK DISTRICT*
OUGLAS G JANNEY, FREDERICKSBURG, *FREDERICKSBURG DISTRICT*
ALPH A BEETON, FALLS CHURCH, *CULPEPER DISTRICT*
OBERT S LANDES STAUNTON, *STAUNTON DISTRICT*
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J. P. ROYER, JR.
DIRECTOR OF PLANNING
P. B. COLDIRON, DIRECTOR OF ENGINEERING

IN REPLY PLEASE REFER TO

April 23, 1975

Dear Resident:

As a result of extensive studies conducted in the areas of Noise Pollution and Citizen Involvement, the decision has been made to construct a noise abatement feature at Group 11.

This barrier will begin paralleling the channel change being constructed along the northbound lane of Interstate Route 495 between Shreve Road and Interstate Route 495, and will consist of a combination concrete and wood sound wall.

Beyond the end of the channel change parallel to Interstate Route 495, an abatement feature consisting of a combination landscaped earth berm and wooden wall will be constructed. This wall berm combination will terminate approximately 150 feet south of the proposed extension of the eastbound lane of Interstate Route 66.

The Department wishes to thank you for your input on this matter and the cooperation and concern expressed at the Public Workshops.

Sincerely,

R. L. Hundley

R. L. Hundley
Environmental Quality Engineer

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case study background data

school

Baltimore Lutheran
Baltimore, Maryland
Baltimore Lutheran High School
Associates, Inc.

Parochial Junior/Senior High School
Grades 7-2, 460 students

1965 Construction of first building

1973 Most recent construction (gymnasium)

Masonry construction. Central air conditioning in classroom buildings, not in gymnasium

The northwest ball field is elevated approximately 10 feet higher than the rest of the campus

highway

I-695, Baltimore Beltway

Interchange #29, Williams Avenue

6 lanes with median

1958: Construction completed.

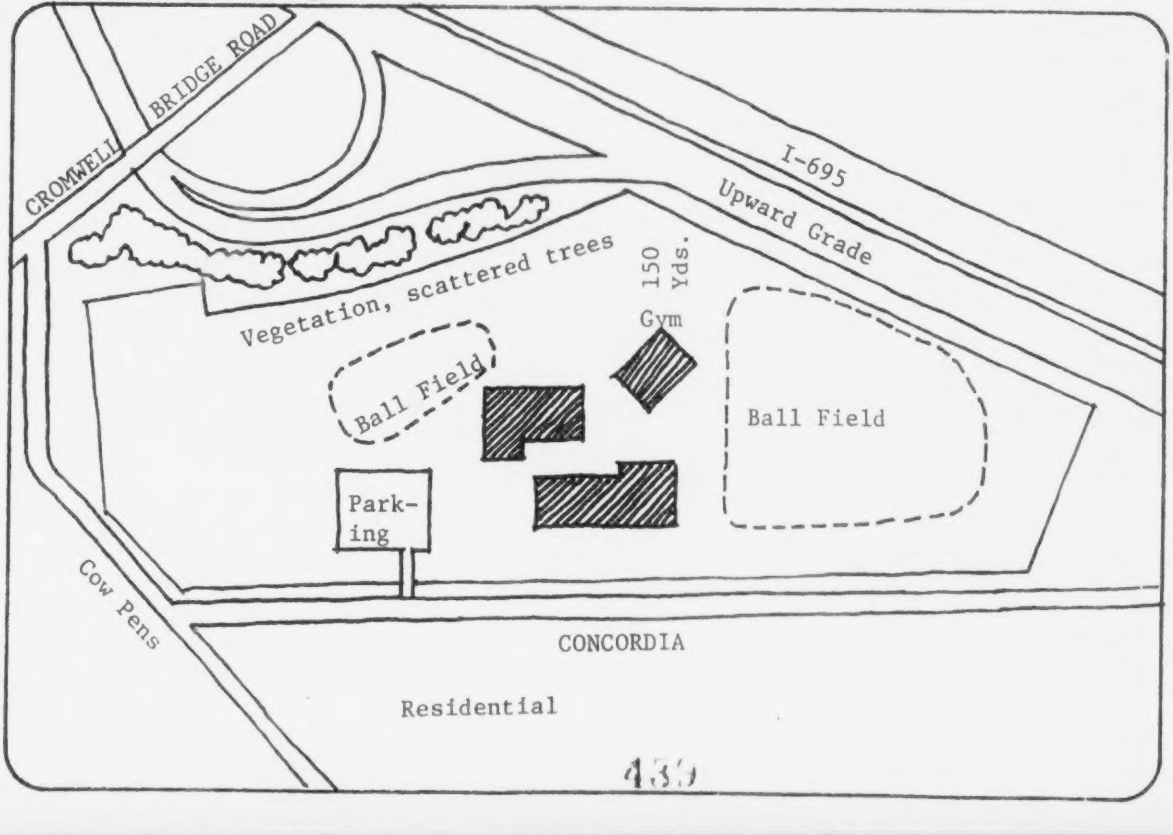
Widening from 6 to 8 lanes

ADT: 74,200 (1974); 130,000 (DY 1999)

Highway is elevated at this point on earth mounding, minimizing the general valley depression. The slope increases on the outer lane (northwest direction)

Traffic is continuous, heavy commute periods, frequent evidence of accidents and congestion

situational diagram



I. SITUATIONAL CONTEXT

A. Highway

Interstate I-695, known as the Baltimore Beltway, was the first urban circumferential highway completed in the nation. The segment adjacent to Baltimore Lutheran High School, at Interchange #29, Cromwell Bridge Road, was completed in early 1959. It is currently being expanded from six lanes to eight lanes. The average daily traffic count is estimated at 74,200 (1974); ADT for design year is projected at 130,000 (1997). Percent of trucks ADT is approximately 9 percent.

The Beltway at this point was constructed on undeveloped land. There are generous vistas for the traveler, as the corridor remains relatively open and undeveloped from its former pasture land usage.

The concept of the Beltway was first proposed by Baltimore County in 1949. In July 1951, the State Roads Commission (now the State Highway Administration of the Maryland Department of Transportation) accepted a revised Baltimore County proposal and reached a cost-sharing agreement. Planning for construction of an initial 5.2 mile section was undertaken; and procurement of land for the rest of the Beltway was authorized. In August 1951, Baltimore County began acquiring land rights.

The route was announced to the public in November 1952. The announcement elicited a certain amount of public protest. According to a news article published at the time of the Beltway's official opening several years later,[1] most of the opposition appeared to stem from a fear of loss of land without adequate compensation, and a general fear related to the novel and unknown nature of the Beltway concept. Citizens sponsored a protest meeting in December 1952.

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Two areas of effort on the part of the highway planners appear to have assuaged public opposition. First, an intensified public relations campaign provided the public with information indicating how disruption of their lives by the Beltway would be minimal; and the advantages of the Beltway in terms of commuter access, attraction of industry, etc. Secondly, in July 1953, the State Roads Commission assumed full responsibility for construction of the Beltway and acquisition of rights-of-way, relieving the County of both the costs and the political accountability.

Although the Beltway route was never incorporated into an officially adopted County Master Plan, public acceptance of the route enabled the County to reserve right-of-way by discouraging conflicting development. In addition to construction of the Beltway itself, planners later noted that the County also enjoyed instances of incidental advantages from the Beltway, e.g., right-of-way purchased and not utilized for the Beltway was appropriated for construction of other roads.

In December 1955, the first section was completed. Federal Interstate Highway funding made possible the construction of the remainder of the Beltway under a 90:10 funding ratio. The entire Beltway was officially completed and opened in July 1962.

The segment of the Beltway at Interchange #29 has a high accident rate, attributed to the combination of curved roadway alignment, hills, and roadway surface conditions.

B. School

Baltimore Lutheran High School is a parochial junior and senior high school, owned by the Baltimore Lutheran High School Association, Inc., currently representing 18 church congregations in the Baltimore area. The association purchased the 25-acre site for the school in 1953. Alternative strategies to establish a parochial high school had been considered, including the purchase and modification of an existing facility, or the lease of an existing facility. However, the Association learned of this undeveloped site and its proximity to an interchange of the planned Beltway factored positively in the decision to purchase. The school facility as conceived was expected to draw students from throughout the greater Baltimore area. At that time there was no parochial high school in the area, and today it is the only parochial high school. Furthermore, the Association anticipated the use of the facility by the congregations for conventions, Bible Institute programs, church services, and various other activities. Therefore it was considered that the planned Beltway would render the site highly accessible.

The design concept for the facility was a cluster of separated buildings, rather than a single, large structure. In 1965, the first classroom building was constructed; in 1968, the second classroom facility; and in 1973, the gymnasium building. Ultimate plans include a separate administration building and a chapel, but at this time no construction date can be projected. The presence of the Beltway influenced the design to the extent that one factor in the decision was the anticipated noise from the Beltway. There is no air conditioning or special noise baffling treatment in the gymnasium, which is used for religious services, meetings and other auditorium activities, as well as athletic classes and events. Another influence of the Beltway on the design of the campus can be seen in the setback of buildings from the property line, which abuts the Beltway right-of-way. The construction of all buildings is of masonry. There are two outdoor play fields at the southeast and northwest ends of the campus. The entire campus slopes gently northward; the northwest ball field is elevated approximately 10 feet on earth mounding.

The site location has in fact proved very desirable. Current enrollment is 460, for grades 7-12. Students are drawn from all directions (absent any catchment area boundaries) and as far away as 30 miles. Some commute 1-1/2 hours each way, driving from their homes to within the service of the buses hired by the school. Group users come from even greater distances.

School hours are 8:30-3:30. The facility is open for school September 1-June 10.

C. Proximity Relationships

The school and adjacent Beltway lie in a valley. The land slopes northward gradually, amid gently rolling hills. Although the highway is elevated on an earth berm, the school's hilly site renders it close to the same elevation. In particular, the height of the main ball field area is comparable. The two facilities are in full view of each other. The closest classroom building and the gymnasium are within 150 yards of the Beltway. This includes a 25-yard Beltway right-of-way, the boundary of which is marked by a 6-foot chain link fence.

Approximately 200 students bus to school. A slightly larger number come by private cars. Only a very few walk. The buses proceed by three boundary development roads to the nearby Beltway on-ramp visible from the school. Almost all school users utilize the Beltway. There are stop signs at the intervening intersections, and a stop light at the intersection of the on-ramp. The school parking lot serves both as bus zone and parking lot for those who drive. Those who walk live within several blocks or catch nearby public transportation.

The developed neighborhood to the north and west of the school is exclusively residential. An active Improvement Association influences development standards. To the west is a public high school, also constructed after completion of the Beltway.

II. IMPACTS

A. On School

The most strongly perceived impact of the Beltway on the school is that of ease of accessibility. Accessibility had been a factor in selection of the site and has, in fact, been afforded by the Beltway. School users attribute to the Beltway both the wide geographic draw of students and the frequent utilization of the facility by community groups. They perceive the benefits of accessibility to far outweigh any adverse impacts.

Another impact, also a consequence of reliance on the Beltway for accessibility, is related to the extensive Beltway traffic congestion, particularly during commute hours. When there is an accident, the school buses and those arriving in private cars may be delayed considerably. The school business manager estimates that this may occur 15-20 times during the school year, i.e., approximately twice a month. Similarly, the construction of improvements has contributed to traffic congestion, as with the present widening of this section by one lane in each direction.

Another impact has been the level of noise. Noise varies over the campus site. Several teachers in the classroom building facing the Beltway volunteered that with windows open they were aware of traffic noise, and sometimes were required to interrupt speech while a truck passed. Truckers sometimes honk at students on the play fields. However, the noise was generally regarded as "something one got used to" and not a major impact. By contrast, homeowners only 50 yards north, who are both at a higher elevation and adjacent to an upward sloping grade, are reported to find the noise level objectionable.

In connection with the State's Type II project noise abatement activities (refer to Appendix A), the segment of I-695 at the Cromwell Bridge Road Interchange has been selected for noise impact assessment activities and is the segment next scheduled for field survey. No measurements have been taken to date.

Visual distraction was also reported as a minor impact in connection with the high frequency of accidents. Children are distracted by the noise of the emergency vehicles to watch rescue activities.

B. On Highway

The impacts of the school on the highway are minor and equivocal. School users generate vehicle trips, but given the essential nature of use, i.e., education, absent this facility, the students would likely use the Beltway to attend alternative schools.

It was also suggested that the activities on the play fields attracted the visual attention of passing motorists.

Recently, the school notified the State Highway Department that the storm drain underneath the Beltway was being used as a play area by neighborhood children, suggesting the hazard of entrapment during a flash flood. However, the school did not identify any of its own students among this group.

III. MITIGATION -- MEASURES PROPOSED AND IMPLEMENTED

The only mitigation measures proposed by the school, and also implemented, were those incorporated in the original design of the facility, i.e., central air conditioning and a setback from the Beltway right-of-way. School users described the negative impacts as minor, and have sought no mitigation.

If the Highway Department's noise assessment studies reveal that the level of exterior and interior noise exceeds federal standards, an analysis of feasible mitigation measures will be undertaken. There was no speculation by highway planners as to probable measures.

IV. SUMMARY

A. Lessons Learned

- The case exemplifies how location adjacent to a highway interchange is desirable for the school attended by geographically widespread users. In this instance, the benefits were anticipated by the school developers and factored in their decision to purchase the site adjacent to the Beltway right-of-way.

- Given satisfaction with the highway's major impact on the school (i.e., accessibility to the region), minor impacts were viewed as "something to live with."

- The elevation of the school at roughly the same height as the highway affords relatively less noise impact than that experienced by nearby residences at higher elevations.

CHRONOLOGY -- BALTIMORE LUTHERAN HIGH SCHOOL

1953: Acquisition of school site (undeveloped) by Baltimore Lutheran High School Association, Inc.

1954: Interchange #29 of I-695, at Cromwell Bridge Road, programmed for federal aid.

1956: Plans, surveys and estimates for Interchange #29 submitted, bids opened, contracts awarded, work started.

1958: Completion of I-695 at Interchange #29.

1959: Final voucher paid for construction of Beltway segment adjacent to Interchange #29.

1965: Construction of first classroom building. Masonry with central air conditioning.

1968: Construction of second classroom building. Masonry with central air conditioning.

1973: Construction of multipurpose gymnasium building. Masonry, without air conditioning.

PERSONS CONTACTED: BALTIMORE LUTHERAN HIGH SCHOOL

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APPENDIX A

MARYLAND DEPARTMENT OF TRANSPORTATION
FEDERAL/FEDERAL-AID TYPE II PROJECTS

Noise Abatement Projects on an Existing Highway Exclusive of Construction or Reconstruction of the Highway

The Maryland Department of Transportation has identified 25-30 acres for investigation as Type II projects under guidelines contained in the Federal-Aid Highway Program Manual, 7-7-3. Most of these areas are located along Interstate roads in the Baltimore area. Among these are the corridors of I-695 at Interchange #12 (Wilkens Avenue) and Interchange #29 (Cromwell Bridge Road).

The program is under the direction of the Department's Bureau of Landscape Architecture, Environmental Section. It was undertaken approximately 2 to 2-1/2 years ago. At that time, the FHwA requested the Department to develop an estimate of the number of eligible Type II projects, such that if funding mechanisms were available, noise abatement measures would be considered.

A "windshield survey" yielded the initial section of areas for study. Also considered were such factors as traffic volume; and the type, chronology and longevity of adjacent development

With the implementation of Type II Project funding mechanisms, the Department has scheduled investigation of these sites. On I-695, one noise abatement project has been implemented and several others are underway. The Department is in the process of developing a guide to conducting Type II projects, describing the scope and stages of work. These include mapping, contours of existing noise levels, listing of criteria to be weighted and prioritized. (Refer to attached "Noise Abatement Priority Rating System," March 1977).

Another stage involves circulation of a questionnaire through the impacted neighborhood, to collect information about both perceived impact and preferences for abatement measures. It is expected that this guide will be available in booklet form by 1978, and may be offered for distribution to the public.

The Type II project guidelines are still in developmental stages and it is unclear at this point whether interior noise level readings will be included in the criteria for the Noise Abatement Priority Rating System.

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

Type II Projects

Noise Abatement Priority Rating System
March 1977

I. Type of Development to be Protected

A. Residential Areas impacted by L_{10} of 70 dBA or greater.

1. If other sensitive receptors, i.e., schools, hospitals, parks, etc. occur within a residential area, points will be added dependent on the individual case.

II. Magnitude of Traffic Noise Impact

A. Five points if development existed prior to the highway.

B. One point for each year development existed since highway was opened to traffic.

C. One point for each five residences impacted by L_{10} of 70 dBA or over.

D. Three points for L_{10} of 70-72 dBA and three points for each 3 dBA L_{10} increment above 72 dBA at most severely impacted noise sensitive area.

E. One point of L_{10} minus L_{90} is less than 10 dBA.

First Phase

Evaluation will be based upon I and II to determine a first-cut priority listing.

Second Phase

Evaluation will consider the feasibility and practicability of construction, achievable noise reduction and funding availability. Emphasis will be placed upon abatement at those areas where construction is physically feasible. Areas where abatement is infeasible or of questionable feasibility will receive a lower priority. A point or points may be deducted where any of these factors are marginal.

Third Phase

Public attitude and involvement will be considered. In general, the public has a desire for noise abatement. Public inquiry and complaint may serve as notification of a potential problem; however, the subjective nature of noise makes it necessary to base priority on factors other than public reaction, since unavoidable built-in bias is normally associated with a noise complaint. If during the development of a specific project, the public indicates that abatement is undesirable from its viewpoint, the project will be postponed and re-evaluated within three years.

case study background data

school

Maiden Choice Elementary School
Baltimore, Maryland
Baltimore County Board of Education

Public, K-6, 605 students

Construction of main building: 1952, ±1957, 1976. Masonry. No central air conditioning.

Detached units: 1970

- 2-room kindergarden annex, single story, pre-fab. concrete
- Instrumental music unit, semi-permanent, aluminum siding, A/C

4 exterior sound barriers, 7' in height, sheet metal panels. Installed 1967.

Main school building is elevated ±20' relative to Beltway. There are 2 descending terraces, and the ball field is generally level, ±10' higher than the Beltway.

highway

I-695, Baltimore Beltway

(Segment adjacent to school)

6 lanes, median strip

1959: Construction completed. Pedestrian overpass installed.

1975: Cage installed around pedestrian overpass.

ADT: 93,000 (1974)
146,000 (DY 1977)

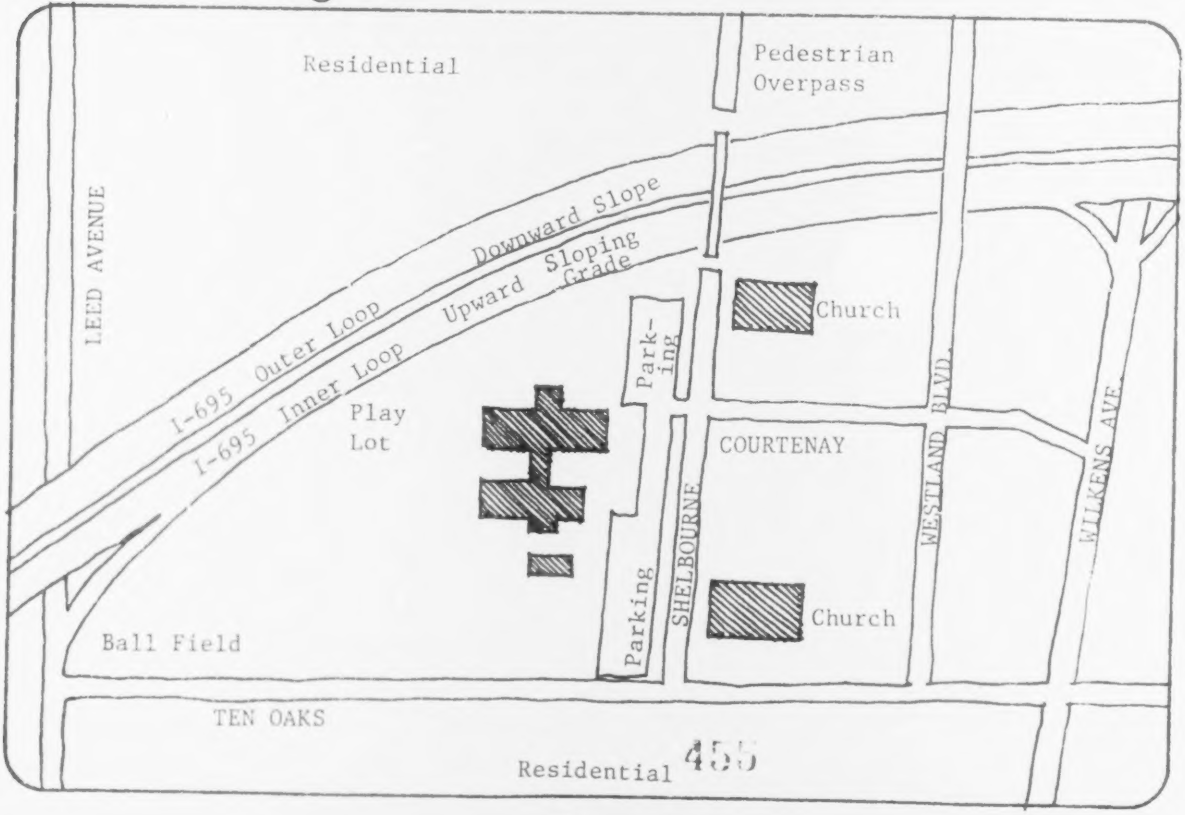
Continuous traffic flow, heavy commute periods.

Inner loop upward grade.

Curved alignment.

Beltway was built on school property, which previously comprised a rectangle, extending to the bank on the far side of the present Beltway.

situational diagram



I. SITUATIONAL CONTEXT

A. Highway

Interstate 695, known as the Baltimore Beltway, was the first urban circumferential highway completed in the nation. The segment adjacent to Maiden Choice Elementary School, between Exits 12 and 12A, is six lanes in width, with additional lanes for entry and exit, and a median strip. The most recent average daily traffic count for this segment is 93,000 (1974), and percent of trucks in the ADT count is 9 percent. For DY 1997, the ADT is projected at 146,000, and ADT percent of trucks at 9 percent.

The concept of the Beltway was first proposed by Baltimore County in 1949. In July 1951, the State Roads Commission (now the State Highway Administration of the Maryland Department of Transportation) accepted a revised Baltimore County proposal and reached a cost-sharing agreement. Planning for construction of an initial 5.2 mile section was undertaken; and procurement of land for the rest of the Beltway was authorized. In August 1951, Baltimore County began acquiring land rights.

The route was announced to the public in November 1952. The announcement elicited a certain amount of public protest. According to a news article published at the time of the Beltway's official opening a decade later,[1] most of the opposition appeared to stem from a fear of loss of land without adequate compensation, and a general fear related to the novel and unknown nature of the Beltway concept. Citizens sponsored a protest meeting in December 1952.

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Although the Beltway route was never incorporated into an officially adopted County Master Plan, public acceptance of the route enabled the County to reserve right-of-way by discouraging conflicting development. In addition to construction of the Beltway itself, planners later noted that the County also enjoyed instances of incidental advantages from the Beltway; e.g., right-of-way purchased and not utilized for the Beltway was appropriated for construction of other roads.

In December 1955, the first section was completed. Federal Interstate highway funding made possible the construction of the remainder of the Beltway under a 90:10 funding ratio. The entire Beltway was officially completed and opened in July 1962. The segment at Exit 12 was completed in August 1959.

Two other major transportation routes were identified as potentially impacting the school site. Approximately 1-1/2 miles to the southeast at the next major interchange, I-95, a major interstate route, intersects with I-495. Also, approximately one-quarter mile to the south of the school site and perpendicular to the Beltway is a high speed railroad line with a current capacity of four tracks, and a potential capacity of seven tracks. The state is mandated by federal regulations to improve the intersection of this railroad line with a local street. It is possible that the design solution will entail re-routing of trucks from the adjacent industrial area through the improved intersection and on to the Beltway by means of the upward-sloping on-ramp abutting the school ball field.

B. School

Maiden Choice Elementary School offers public education for grades K-6, including two sections of special education, in the jurisdiction of the Baltimore County Board of Education. Current enrollment is 605, projected to remain steady for some years and then decline. The main facility forms an "H" shape. Separate free-standing structures include a two-room, prefabricated, kindergarten annex and a one-room, sheet metal unit used for instrumental music. The original building opened in 1952 as a twelve-room school; it was effectively "doubled" within four-five years. The detached units were added in 1970. The most recent addition, completed in the fall of 1976, is a three-room office suite. The entire main section is of masonry construction. Only the new office suite and the two free-standing units are air-conditioned. The principal commented on the good quality of construction, its insulation and the radiant heating in the floor slab.

School hours during the winter are 8:45-3:15. Summer school is offered. The school is also utilized for various community activities during evening and weekends, including public meetings, formal and informal Recreation Department activities, etc.

The school site forms a rough triangle, with the school buildings and parking areas at the base. Two descending terraces, totaling approximately 12 feet in height, separate the school building elevations from the play areas so that the play field is generally level, except at borders. The ball fields occupy the apex area of the site. Scattered shrubs and small trees occur randomonly along the length of the fence. There is a continuous chain link fence along the Beltway right-of-way.

The school is located outside of the city line by less than one mile, within the jurisdiction of the Baltimore County Board of Education.

C. Proximity Relationships

The surrounding neighborhood is older and residential, with some convenience-type commercial development. Most of the structures in the immediate area are attached townhouses or low-rise apartments. The school's service area to the west of the Beltway is characterized by older, single family detached homes. Of note regarding the school-age population is an influx in recent years of newly immigrating Korean families. However, the population of this area and the County in general is shrinking.

The Beltway follows a relatively steep grade adjacent to the school, the inner loop sloping uphill. At the deepest point of the play field, the school site is about 10 feet higher than the Beltway. The terraces render the school buildings approximately 20 feet higher than the Beltway. The children's play lot is approximately 100 feet from the Beltway and the nearest classroom about 75 yards.

Shelbourne Road, in front of the school, terminates short of the Beltway, and is replaced by a caged pedestrian overpass across the Beltway. The great majority of students walk; some are brought by parents in private cars; approximately 8 percent are bussed. The walkers arrive from areas both to the west (across the Beltway) and east.

The school buses cross the Beltway via Westland Boulevard (parallel to Shelbourne, one block to the north), but do not enter the Beltway. The principal of the school estimates that few private cars bringing students utilize the Beltway in their routes. There are three crossing guards from the County Police Department at local intersections to the north and east of the school.

II. IMPACTS

A. On School

The major impacts on the school, as identified by school users, have been reduction of total and usable outdoor play area acreage, and noise and air pollution. A minor impact has been a decrease in utilization of the facility for formal community activities, related to the decrease in desirability of the playing fields.

In October 1956, the State Roads Commission (SRC) notified the Board of Education of the proposed Beltway right-of-way alignment and suggested an option agreement to purchase 3.1 acres of the school site. Although the transaction did not go into condemnation, there was considerable delay in the completion of the agreement. Representatives of the county school system today recalled no opposition to the proposal. At that time, the method of notice and option agreement was routine. Construction was undertaken in 1957. However, a year and a half passed before signature of the title was obtained in June 1958. In the meantime, the principal of Maiden Choice pursued several concerns related to the acquisition and initial construction activities with the school superintendent.

The principal's concerns were:

1. The SRC had constructed a snow fence along the boundary line between the school playground and the Beltway. Portions of the fence were frequently torn down as construction proceeded. The principal had been unsuccessful in securing a commitment from the SRC to maintain the fence in good order. He considered the fence a necessary safety measure to keep children out of the construction area.

2. The SRC had proposed construction of a six-foot high permanent fence along the boundary line upon completion of the Beltway. The principal felt that a fence of 10 feet to 12 feet height was more desirable, in order to maximize the decreased playground area, so that games involving balls could be played closer to the edge of the property.

3. Also with regard to the permanent fence, the principal sought assurance that it would extend far enough beyond the school boundary to prevent the children from gaining access to the Beltway.

4. The principal was concerned that the pedestrian overpass be designed to ensure the safety of student users from possible falls.

The principal noted that he and members of the P.T.A. had been unable to secure a response to these issues from the SRC.

The superintendent passed this letter on to the SRC; and correspondence indicates that the SRC arranged for a meeting between its engineers and the school principal in April 1957. As stated, the agreement was signed in June 1958, and that segment of the Beltway completed in August 1959.

The current principal recalls the school before construction of the Betlway as an ample, pleasant environment, well-suited to the older character of the residential Arbutus area. His assignment to the school in July 1975 introduced him to a radically changed situation.

The loss of the right-of-way property effectively rendered the formerly rectangular site a right-angle triangle. The playground area was reduced by nearly one-half. The Board of Education attempted to offset this loss by acquisition of 1.5 adjoining acres. Nevertheless, the usable acreage for field sports was reduced to the point where it is rarely utilized for community sports activities of older children capable of longer-range movement. Furthermore, usage of the remaining play area is intensified, thereby contributing to excessive conditions of wear.

The noise impact was evident immediately. Contributing factors are the heavy volume of traffic; an upward grade on the inner loop of the Beltway at this point and the on-ramp, necessitating shifting of gears by trucks; and the depression of the Beltway relative to the school buildings.

Measures of noise impact include changes in the use of the nearest classrooms and physical education activities on the field, teacher and student perceptions, and decibel readings for other segments of the Beltway. During the first years of Beltway operations, teachers in classrooms adjacent to the Beltway reported that they could not be heard over the noise of passing trucks. The principal for the school in 1959-1960 characterized the noise element as "tremendous." To the extent possible, the two nearest rooms were utilized only for temporary activities.

After installation of the exterior noise baffles in July 1967 (cf. III. Mitigation Measures), the succeeding principal characterized the noise reduction as "dramatic," and regular classroom use was resumed. However, when the present principal attempted to teach a special summer section in one of these rooms several years ago, he found the effect of the noise manageable with the windows closed, but discussion "a lost cause" with the windows open. Summer school sessions are generally held exclusively in the free-standing, air-conditioned units, as windows may be kept closed; and in the gymnasium. During the school year, the semipermanent unit closest to the Beltway is utilized for instrumental music instruction, partly because its independent heating and cooling system again permits closed windows.

Because of the noise level, it is difficult to give instruction outside of the school building. The physical education teacher usually instructs the students within the gymnasium prior to going outside. The principal particularly praised the teacher for the fine quality of her work in spite of the adverse conditions.

There are no decibel readings of noise impact at the Maiden Choice site. However, at Exit 18 to the north, the State Highway Administration has taken measurements of exterior noise levels which range from 70-80 dBA. The measurements were taken on residential sites adjacent to the Beltway. It should be noted that the slope of grade is steeper at the Maiden Choice site, so that noise levels attributable to trucks may be somewhat higher.

The present principal of the school also expressed concern over increasing air pollution . As indicators, he offered both his personal experience of the contrast between air quality at the school and elsewhere; and a comment to him by a representative of the Office of Building and Grounds Maintenance related to the greater corrosion of the fencing adjacent to the Beltway (of cheaper grade than that used elsewhere on the site). As with the noise impact, he couched his concern in terms of the unknown physiological effects on school users. He noted that the Beltway intersected with Interstate 95, also a heavily traveled route, just 1-1/2 miles to the south, and that the school was subject to pollution from this route as conveyed by a prevailing westerly wind.

The Beltway did not change the school's service area, although it did change the pedestrian and vehicle approach to the school. Shelbourne Road was formerly a major arterial connecting the school to its service area west of the present Beltway. When it was cut off by the Beltway, vehicles were forced to go one block north to Westland Avenue, which crosses the Beltway by means of an overpass. In place of Shelbourne Road, a pedestrian overpass was installed at the time of construction of the Beltway, which is utilized both by Maiden Choice students and by students of the high school on the other side of the Beltway. The principal reported that parental concern about the personal safety of their children from molesters motivated some parents to accompany children. There have been no incidents of this sort in recent years, and it would be problematic to ascribe historic cases to the presence of the Beltway.

There is a continuous chain link fence along the entire length of the Beltway, and there have been no incidents related to children's access to the Beltway.

B. On Highway

In July 1975, the pedestrian overpass was caged by the State Highway Administration, as were all other such overpasses on Interstate roads. There had been instances at other overpasses of users throwing objects onto highways. One incident resulted in the deaths of two automobile occupants. However, there were no incidents reported at the Shelbourne Road overpass; apparently it was enclosed as part of a general program.

The only other potential impact of the school on the highway is related to the outcome of noise surveys currently underway. Should the State Highway Department determine that additional sound barriers are necessary, these may alter the visual landscape of the highway user.

III. MITIGATION

Measures Proposed and Implemented

Records are available only of mitigating measures actually implemented or those presently under consideration. No information is available as to unsuccessfully proposed measures. Measures generated and adopted by the State Highway Administration have been part of broad programs, rather than a unique response to the Maiden Choice situation. There has been no coordinated planning of mitigation measures with the Baltimore County Board of Education. The SHA has been responsible for:

- Construction of the pedestrian overpass at Shelbourne Road, coincidental with construction of the Beltway;
- Construction of a continuous chain link fence along the boundary of the Beltway right-of-way, also coincidental with construction; and
- Enclosure by caging of the pedestrian overpass, in response to incidence of traffic hazards elsewhere on Interstate roads.

In connection with the State's Type II project noise abatement activities (refer to Appendix A), the segment of I-695 adjacent to Maiden Choice Elementary School is scheduled for investigation in FY 1978. Given the relative elevation of the school building, the chief administrator of this program predicts that little consideration will be given to construction of a sound barrier, which would have to be 30 feet or more in height. Rather, the SHA is more likely to recommend some kind of architectural modification to the school building itself, such as double glazed windows and a ventilation system. Such measures would have the additional virtues of addressing air pollution impacts as well. He also suggested that the impact of noise on the play field might be qualified by the consideration that interference with the outdoor activities of elementary school children would be less disruptive than interference with the activities of older children, typically involving more instruction and verbal interaction.

For its part, the Board of Education has undertaken abatement measures exclusively in response to specific requests by school principals. It has no impact assessment or mitigation investigation unit. It should be noted that the principal of Maiden Choice remarked on the autonomy accorded principals in Baltimore County, and his complete satisfaction with the responsiveness of the maintenance office. At the time of original construction, the Board did act to convey the principal's concerns to the State Highway Administration. Also, in summer 1967, at the principal's request for some type of abatement action, the Board authorized the design and installation of exterior sound barriers, consisting of four lengths of ±7 feet high sheet metal panels. The cost of installation was approximately $1,500-$2,000. There is no record as to whether alternative measures were considered. Although the baffles were felt to be effective in reducing the noise level, school users still find the noise disruptive.

The present principal reports that concern about the noise has been expressed by parents and school staff over the years, but there has been no concerted effort to obtain satisfaction. He himself has asked the Board of Education to consider the construction of a facing brick wall and the installation of airconditioning for the southwest wing of the school.

Future plans for the school address the condition of the flat roof of the main building which has sagged between supports under the weight of collecting water. The Board intends to install drains to carry off the excess water. Since the present design indicates exposed drains, the principal is hopeful that consideration will be given to lowered ceilings and modernized lighting.

IV. SUMMARY AND RECOMMENDATIONS

The situation at Maiden Choice Elementary School exemplifies many of the "classic" problems associated with the expediencies of early highway planning approaches. The present relocation specialist suggested that given the same highway design decisions today, the department would probably either fund the acquisition of additional acreage for the school and construction of the baffles; or relocate the school. However, given the opportunity to redesign this segment, the highway engineers would undoubtedly seek alternatives to such features as the relatively steep grade, curved alignment, narrow right-of-way, and relatively lower elevations that generate the excessive noise impact. In other words, the lessons implied by the Maiden Choice situation hopefully are useful only for retroactive programs, since modern design approaches would preclude the repetition of the conditions that created the impacts.

A. Lessons

- In this case, the general ambient roadway noise level is sufficiently loud indoors (with windows open and exterior noise baffles in place) to influence instruction techniques. Prior to installation of the baffles, teachers and students could not sustain activities in the two most affected classrooms on a regular basis; and even with the baffles, classroom users experience strain and distraction. Outside the average noise level interferes with the teaching process, noise-sensitive games, and interaction between the children. The latter may be particularly significant with regard to the experience of those Korean children who are not fluent in English. In addition to the ambient noise level, occasional sources of noise originate from the use of the upward-sloping on-ramp.

- The use of the open area for ball games (as well as traffic safety) is constrained by the existing potential for balls played close to the fence to transcend it. The utility of the ball field is reduced by a reduction in total acreage and the slope of the land at the apex of the field.

- Both pedestrian and passing vehicle safety is enhanced by enclosure of the pedestrian overpass.

- The principal can serve as an effective focus for impact assessment and mitigation efforts, calling attention to the situation, providing information about it, and suggesting appropriate mitigation measures.

- Given a narrow right-of-way, close proximity of the highway to the school, and the relatively higher elevation of the school building, structural modifications may be the only feasible, effective abatement measures.

B. Recommendations

- Among the school users, the Board of Education and the State Highway Administration, the greatest capability to act on situations of adverse school/highway impacts is vested in the State Highway Department. This is a function of the institutionalization of procedures for addressing such situations, including federal and state mandated review and funding mechanisms. Given the requisite scope of technical knowledge and the staffing requirements, this appears to be an appropriate allocation of roles. However, the school users and the Board of Education should contribute to this process, providing subjective perceptions of impact, serving as liaison with the neighboring community, identifying unique impacts, and anticipating impacts in the planning of new school facilities. The Highway Department should structure its assessment project to include direct contact with the principal.

- Comprehensive land planning, with transportation corridors included as a land use, should be utilized to insure compatibility of development. Local governments are responsible for imposing development and design standards which implement this comprehensive perspective.

CHRONOLOGY -- MAIDEN CHOICE ELEMENTARY

1950:	Baltimore County Board of Education acquires the property.
1951:	Beltway plan adopted by the State Roads Commission.
1952:	Construction of the original 12-classroom school building. Public announcement of Beltway route.
October 1956:	I-695 at Interchange #12, Wilkens Avenue, programmed for federal aid. Plans, surveys and estimates submitted.
October 1956:	State Roads Commission (SRC) notifies the Board of Education of the proposed Beltway right-of-way alignment, and mails the right-of-way title for signature. Construction begun.
January 1958:	Board of Education acquires 1.5 acres adjacent to the school site to offset the anticipated loss of land to the Beltway.
June 1958:	Sale of 3.13 acres by the Board of Education to the State Roads Commission for the Beltway right-of-way.
August 1959:	Completion of I-695 at Interchange #12 and pedestrian overpass.
1967:	Board of Education installs sound barriers.
1970:	Addition to the school of a prefabricated concrete, free-standing, 2-room kindergarten annex. Construction of a semi-permanent, free-standing 1-room unit, of wood frame with aluminum siding and equipped with air conditioning.
1975:	Installation of a cage on the pedestrian overpass.
Fall 1976:	Completion of a 3-room office site.

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